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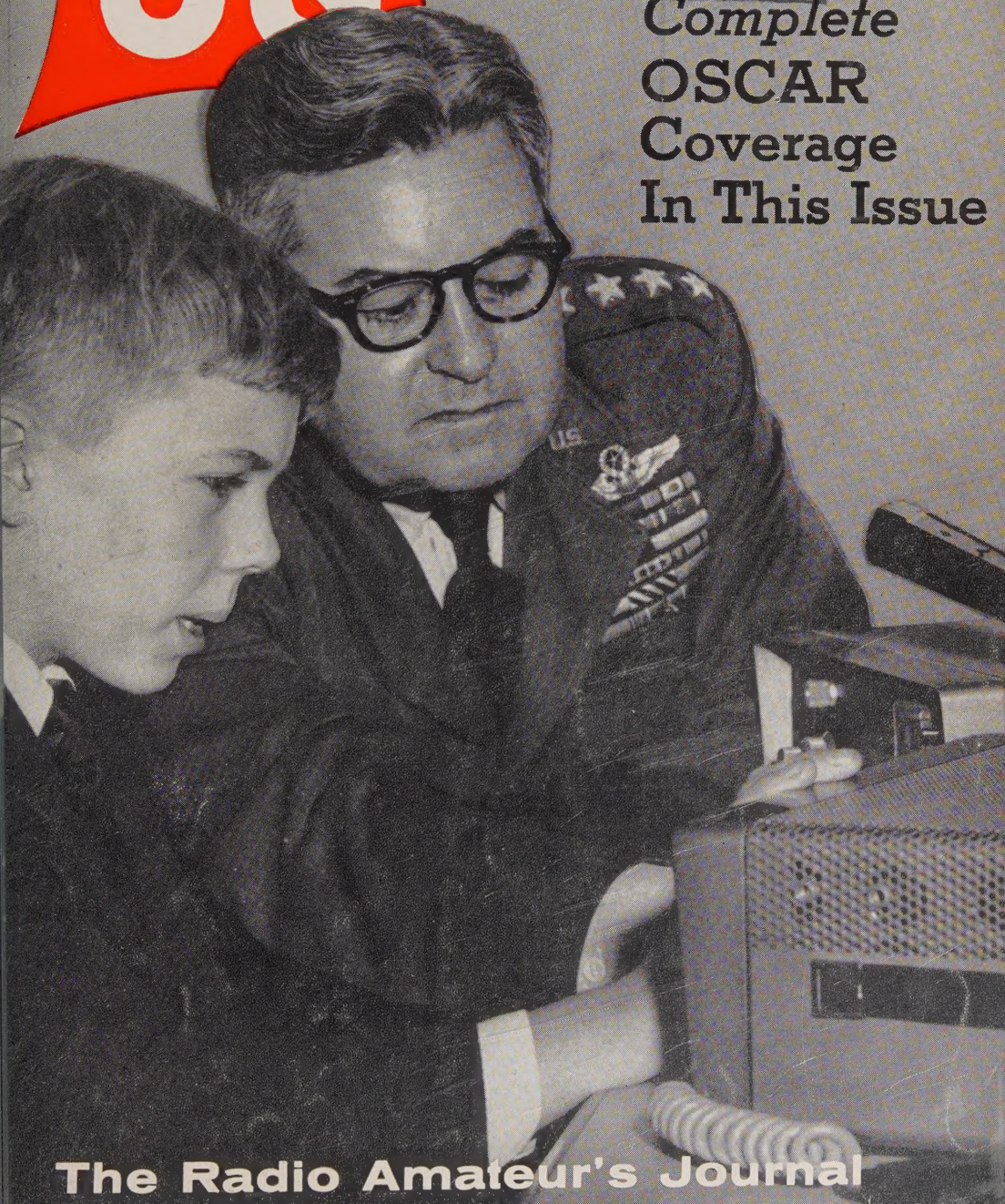
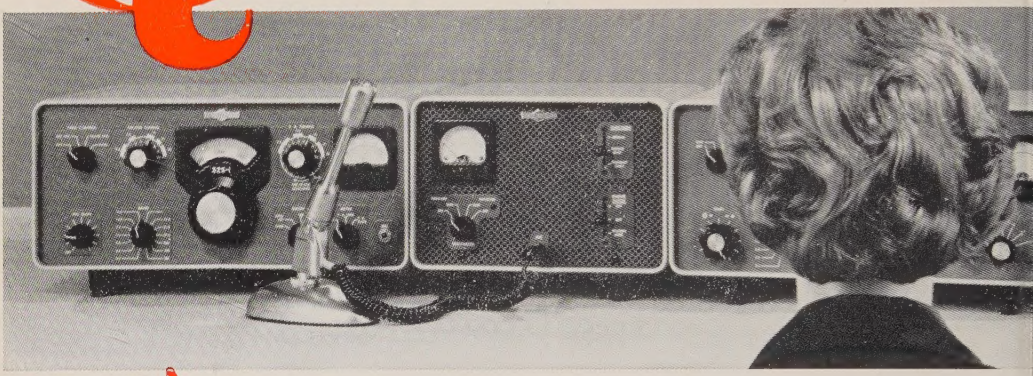


The Radio Amateur's Journal

Q

how do XYL's really feel about ham gear?



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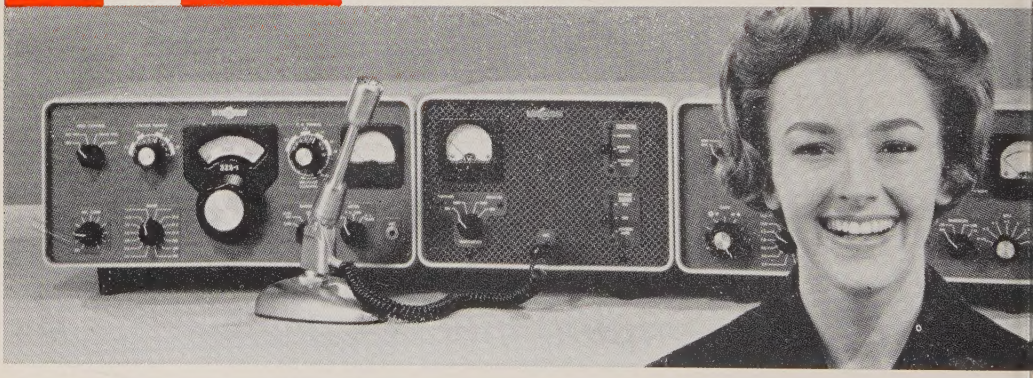
enthusiastic... when it's styled by Collins!



The clean, smooth lines of the famous Collins S/Line make this system-engineered single s band station most welcome in your den or the family room. Collins S/Line wins the XY acclaim because it is stylish and blends with the decor of any room. Collins is the finest. takes up less room... there's no clutter... and it's economical.

P. S. These are only plus factors. What *you'll* go for is Collins' performance.

COLLINS

For further information, check number 1, on page 118

It pays to insist on

PR *crystals*

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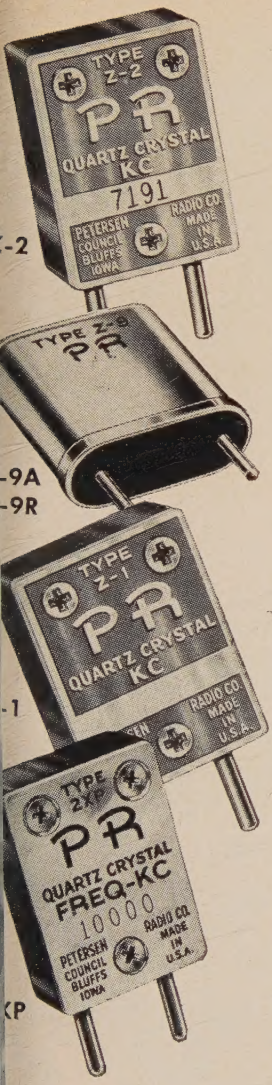


AMATEUR TYPES

Fundamental, PR Type Z-2

Frequency Ranges in Kcs.: 3,500 to 4,000 (80M); 7,000 to 7,425 (40M); 8,000 to 8,222 (2M); 8,334 to 9,000 (6M).

Rugged. Low drift, fundamental oscillators. High activity and power output. Stands up under maximum crystal currents. Stable, long-lasting; ±500 cycles..... **$2.95** Net

(All Z-2 Crystals calibrated with a load of 32 mmfd.)

Third Overtone, PR Type Z-9A

Hermetically sealed; calibrated 24,000 to 24,666 and 25,000 to 27,000 Kc., ±3 Kc.; .050" pins..... **$3.95** Net

6 Meters, PR Type Z-9A

Fifth overtone; for operating directly in 6-meter band; hermetically sealed; calibrated 50 to 54 Mc., ±15 Kc.; .050" pins. **$4.95** Net

CITIZENS BAND CLASS "D"

Type Z-9R, Transmitter

FCC assigned frequencies in megacycles: 26.965, 26.975, 26.985, 27.005, 27.015, 27.025, 27.035, 27.055, 27.065, 27.075, 27.085, 27.105, 27.115, 27.125, 27.135, 27.155, 27.165, 27.175, 27.185, 27.205, 27.215, 27.225, 27.255, calibrated to .005%. (Be sure to specify manufacturer and model number of equipment) $2.95 Net

CITIZENS BAND CLASS "D"

Type Z-9R, Receiver

Specify I.F. frequency, also whether receiver oscillator is above or below transmitter frequency. Calibrated to .005%. (Be sure to specify manufacturer and model number of equipment.)..... $2.95 Net

Type Z-9R, Radio Control

FCC assigned frequencies in megacycles: 26.995, 27.045, 27.095, 27.145, 27.195, 27.255; calibrated to .005%. (Be sure to specify manufacturer and model number of equipment.)..... $2.95 Net

COMMERCIAL TYPES

Commercial Crystals available from 100 Kc. to 70 Mc. Prices on request.

Type Z-1, MARS and CAP

Official assigned frequencies in the range. Calibrated to .005%. 1600 to 10000 Kc..... **$3.45** Net

Type Z 1, TV Marker

Channels 2 thru 13.... **$6.45** Net

4.5 Mc. Intercarrier, .01%..... **$2.95** Net

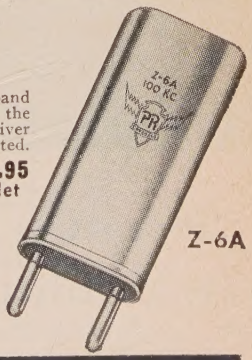
5.0 Mc. Signal Generator, .01%..... **$2.95** Net

10.7 Mc. FM, IF, .01%..... **$2.95** Net

Type Z-6A, Frequency Standard

To determine band edge. To keep the VFO and receiver properly calibrated.

100 Kc. . . **$6.95** Net



Z-6A

Type 2XP

Suitable for converters, experimental, etc. Same holder dimensions as Type Z-2.

2000 to 12000 Kc., (Fund.) ±5 Kc..... **$3.45** Net

12001 to 25000 Kc. (3rd Overtone) ±10 Kc..... **$4.45** Net

PR CRYSTALS ARE UNCONDITIONALLY GUARANTEED. ORDER FROM YOUR JOBBER.

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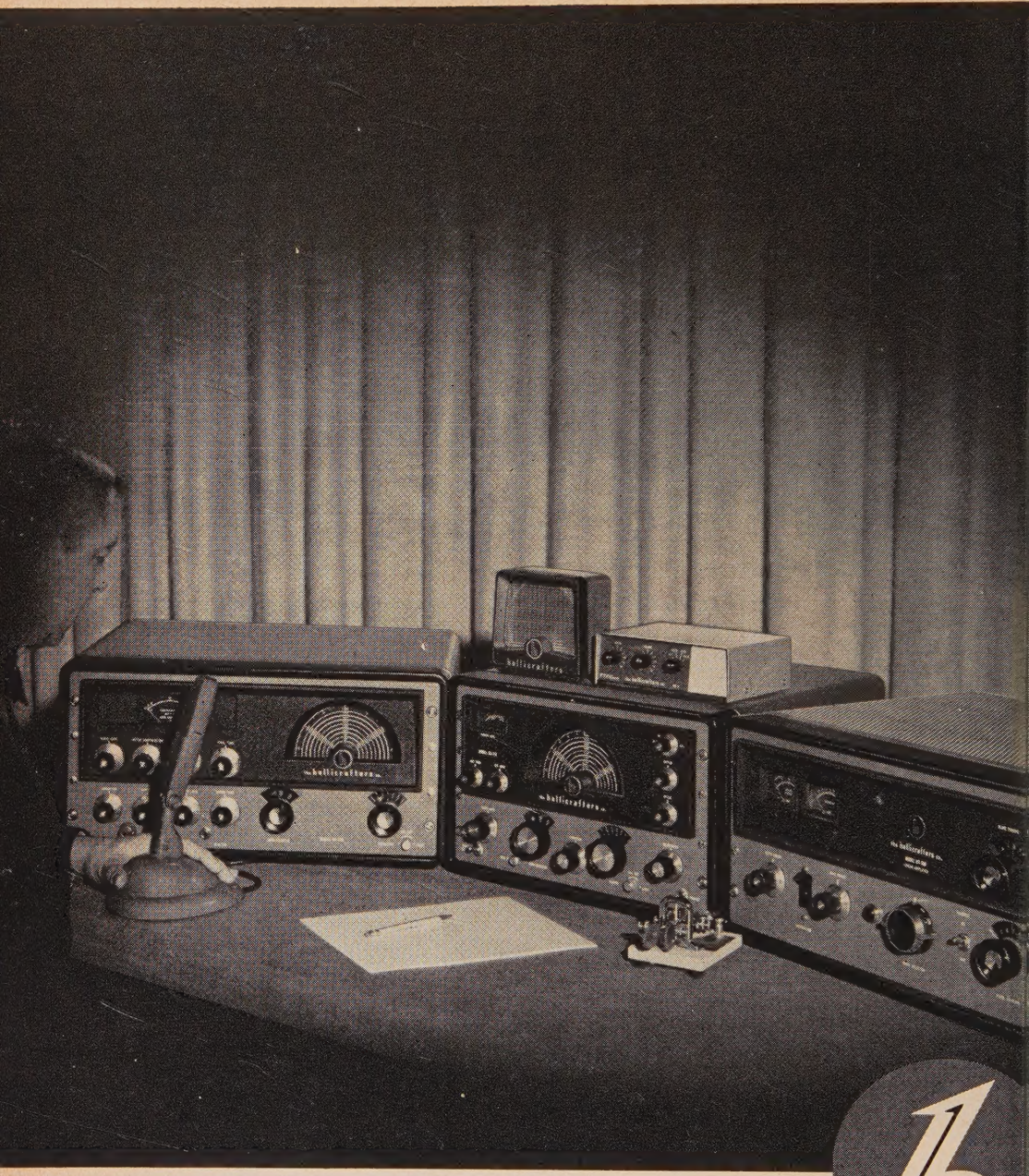
EXPORT SALES: Royal National Corporation, 250 W. 57th Street, New York 19, N. Y., U. S. A.

For further information, check number 3, on page 118

R-47 Speaker HA-4 Keyer
HT-32B Transmitter SX-115 Receiver HT-33B Linear Ampl



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CQ The Radio Amateur's Journal

VOL. 18, NO. 2 FEBRUARY 1962

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CQ—(Title registered U.S. Post Office) is published monthly by Cowan Publishing Corp. Second class postage paid at New York, N. Y. and at Garden City, New York. Subscription Rates: U.S.A. and Possessions, APO, FPO, Canada and Mexico: one year $5.00; two years $9.00; three years $13.00. Pan-American and foreign, one year $6.00; two years $11.00; three years $16.00. Printed in the U.S.A.

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Postmaster: send Form 3579 to *CQ*, 300W. 43rd St., N. Y. 6, N. Y.

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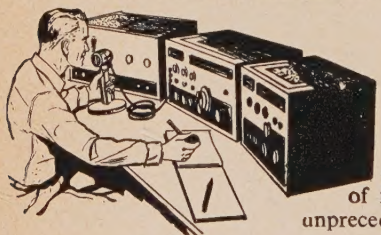
COUNT EM! 33 GREAT FEATURES O



Presenting the "Marauder" . . . performance and features that cannot be duplicated for less than twice the price!

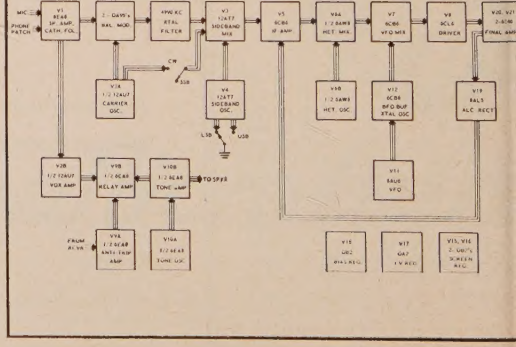
Over two years were spent in the development of this new Heat Single Sideband transmitter to bring you performance, quality dependability unheard of in this price range! The outstanding a of features listed, plus its beautifully styled exterior all add up to unprecedented amateur radio value!

The attractive front panel layout with edge-lighted meter and slide-rule tu dial is accented by chrome-plated die-cast zinc knobs. All controls are located in fr where you want them, for maximum ease of operation . . . no doors or hatches to o or equipment to move! Here is a transmitter that was designed with "you" in mind, a tr mitter to fill the requirements of the most demanding amateur radio operator, a transm you will be proud to own and operate for years to come! Order your Heathkit HX-10 SSB tr mitter today! Send for free schematic. 92 lbs.

Heathkit HX-10...no money dn., as low as $22 mo.....**$334**
Available After February 25, 1962

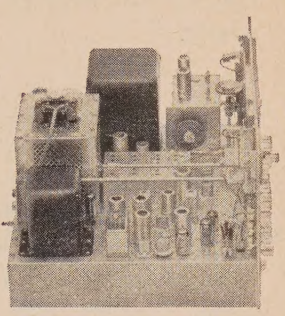
SPECIFICATIONS—Emission: SSB (upper or lower sideband), CW, AM and FSK. **Power input:** 180 watts PEP—SSB and CW, 75 watts AM. **Output impedance:** 50 to 75 ohms with not more than approximately 2:1 SWR. **Frequency range (MC):** 3.5 to 4.1; 6.9 to 7.5; 13.9 to 14.5; 20.9 to 21.5; 27.9 to 28.5; 28.5 to 29.1; 29.1 to 29.7. **Frequency stability:** within 100 cps, overall. **Carrier suppression:** 50 db below peak output. **Unwanted sideband suppression:** 55 db below peak output. **Keying characteristics:** Break-in CW provided by operating VOX from a keyed tone using grid-block keying. **Audio input:** High impedance microphone or phone patch. **Audio frequency response:** 400 to 3000 cps at ± 3 db. **Power requirements:** OFF 14 watts; STANDBY—200 watts; KEY DOWN —400 watts at 117 volts, 50/60 cycles AC. **Cabinet size:** 19" W x 11⅝" H x 16" D.

MICROPHONE ACCESSORY—Ideal for use with the HX-10, this Electro Voice dynamic microphone has been modified to our specifications especially for SSB operation. Frequency response is limited from 300 to 3,000 cps with sharp cutoff above 3,000 cps. Chrome-plated mike stand has grip-to-talk switch with lock. Hi-Z output. Complete with 6' single and 6' multiple conductor shielded cable and instructions to accommodate any installation. 2 lbs.
HDP-21 . . . No money dn., $5 mo.....**$29.40**

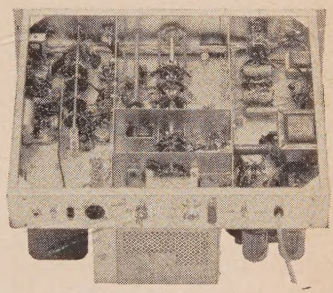


HEATHKIT'S NEW HX-10 SSB TRANSMITTER

1. FIRST FILTER-TYPE SSB TRANSMITTER IN KIT FORM!
2. COMPLETE, NOTHING EXTRA TO BUY!
3. ALL POWER SUPPLIES ARE BUILT-IN.
4. ALL CRYSTALS FURNISHED FOR FULL 80 THROUGH 10 METER COVERAGE
5. BEAUTIFULLY DESIGNED & RUGGEDLY BUILT—OVER TWO YEARS IN DEVELOPMENT
6. OPERATES SSB (upper or lower sideband), CW, AM, & FSK
7. 180 WATTS PEP—SSB & CW . . . 80 THROUGH 10 METERS
8. CARRIER SUPPRESSION 50 DB; UNWANTED SIDEBAND SUPPRESSION 55 DB
9. MULTI-SECTION, HERMETICALLY SEALED CRYSTAL BAND-PASS FILTER
10. DUAL CONVERSION; CRYSTAL CONTROLLED HETERODYNE OSCILLATOR
11. PREHEATED, TEMPERATURE COMPENSATED VFO FOR HIGH STABILITY
12. AUTOMATIC LEVEL CONTROL FOR HIGHER TALK POWER WITHOUT DISTORTION
13. BREAK-IN CW OPERATION (VOX CONTROLLED)
14. STRAIGHTFORWARD CIRCUIT LAYOUT AND WIRING HARNESS FOR EASY ASSEMBLY
15. UNIQUE ALIGNMENT PROCEDURE, REQUIRES ONLY A CALIBRATED GENERAL COVERAGE RECEIVER AND VTVM WITH RF PROBE
16. 165 to 1 WORM GEAR, SPRING-LOADED TUNING ASSEMBLY FOR SMOOTH ANTI-BACKLASH TUNING
17. APPROXIMATELY 10 KC PER TURN FOR SHARP, EASY FREQUENCY SELECTION
18. SPINNER KNOB FOR RAPID FREQUENCY EXCURSIONS
19. LOGGING SCALE FOR EXCELLENT RESETABILITY
20. AIR COOLED, SHIELDED FINAL AMPLIFIER—NOISE-FREE FAN
21. SPOT CONTROL ALLOWS "ZERO BEAT" OR "TALK-ON" FREQUENCY SPOTTING
22. FRONT PANEL CONTROLLED VOICE CONTROL (VOX) & PUSH-TO-TALK (PTT)
23. MONITORING OSCILLOSCOPE JACK WITH BUILT-IN VARIABLE AMPLITUDE CONTROL
24. SEPARATE HIGH Z PHONE PATCH INPUT ON REAR CHASSIS APRON
25. METERED GRID, PLATE, ALC, RELATIVE POWER & HIGH VOLTAGE CIRCUITS
26. FSK JACK FOR DIRECT RTTY POLAR RELAY KEYING
27. FULL FUNCTION ACCESSORY OCTAL SOCKET FOR RECEIVER MUTING, AMPLIFIER CUTOFF BIAS, 117 VAC ANTENNA RELAY POWER, RECEIVER SPEAKER MUTING.
28. SWITCHED 117 VAC OUTLET FOR ACCESSORY EQUIPMENT SUCH AS MONITOR SCOPE.
29. PARALLELED 6146's IN FINAL OPERATING CLASS AB1
30. HEAVY-DUTY 16 GAUGE STEEL CHASSIS AND CABINET CONSTRUCTION
31. COPPER-FLASHED CABINET INTERIOR FOR EXCELLENT SHIELDING
32. ALL ADJUSTMENTS, CONNECTIONS AND TUBE NUMBERS ARE CLEARLY SCREENED ON THE CHASSIS FOR EASY IDENTIFICATION
33. ALL CONTROL FUNCTIONS ARE LOCATED ON THE FRONT PANEL—NO DOORS OR HATCHES TO OPEN—CONVENIENT TO OPERATE



TOP VIEW—Quality components used throughout assure years of dependable, trouble-free performance. Shielded final amplifier is forced-air cooled by a noise-free fan. Chassis screening clearly identifies all tubes, adjustments, etc. for future reference.



BOTTOM VIEW—Compartmental construction provides necessary isolation and shielding of transmitter sections for top performance . . . adds rigidity to the chassis for rugged, dependable service and long life. Neat circuit layout through careful design and a precut, cabled wiring harness permit easy assembly.

HEATH COMPANY

Benton Harbor 12, Michigan

FREE 1962 CATALOG—Full description of over 250 different Heathkit products in Amateur Radio, Hi Fi, Test, Marine, and General consumer items. The world's largest selection of easy to build kits. Send for your free copy today!

☐ Please send me my copy of the 1962 Heathkit Catalog.

NAME_____

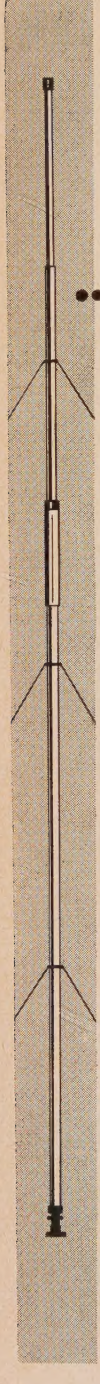
ADDRESS_____

CITY_____ STATE_____

For further information, check number 5, on page 118

IF YOUR CHOICE IS A VERTICAL

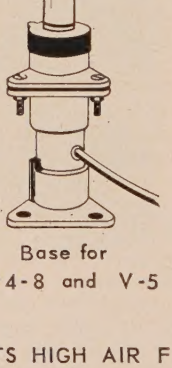
Mosley will help you choose an antenna to fit your personal needs.



V-4-8 PERFORMANCE EQUAL TO SEPARATE 1/4 WAVE-LENGTH VERTICALS!

For 40 and 80 meters, this heavy duty 100% rust proof antenna easily handles 1 KW (AM). The V-4-8 comes complete with cycolac base mount, polyethylene guy rope and hardware.

Amateur Net, $85.00.



Base for V-4-8 and V-5

V-5 MEETS HIGH AIR FORCE REQUIREMENTS!

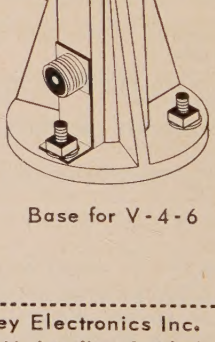
Work 10, 15, 20, 40, and 80 with one antenna... one RG/8U feedline. The V-5 is 100% rust proof and performs brilliantly on each of 5 bands. Handles power of 1 KW to the antenna. Supplied complete with polyethylene guy rope, heavy duty base with internal coax fitting and all necessary hardware.

Amateur Net, $118.50.

V-4-6 HIGH IN PERFORMANCE, LOW IN PRICE!

No bandswitching is necessary on this excellent DX antenna. Exclusive design provides low SWR with response exceptionally flat across full width of each band. Weather proof traps ...easy to assemble... the most popular vertical ever built for 10, 15, 20 and 40 meter operation.

Amateur Net, $27.95.



Base for V-4-6

Mosley Electronics Inc.

Mosley Electronics Inc.
4610 N. Lindbergh Blvd. Bridgeton, Mo
Please send me detailed specifications performance ratings and the name of m nearest distributor of the followin Mosley antennas.

☐ Model V-4-6 ☐ Model V-4-8
☐ Model V-5

Name.....
Address.....
City..... Zone..... State.....

CQ-2-

For further information, check number 6, on page 118

ZERO BIAS

SINCE the launching of Project OSCAR on December 12, 1961, many amateurs have raised the question: "why?" CQ feels that Project OSCAR is but one way of showing that amateur radio serves both science and nation. The following, "OSCAR Concept" written by the Project OSCAR Association, sums up the philosophy of OSCAR, and since we agree with the concept one-hundred per-cent, it is our pleasure to use it in place of our regular editorial comment, to run simultaneously with the OSCAR I report starting on page 24 of this issue.

FOR better or worse, the citizens of the world entered the space age on October 4, 1957 when the U.S.S.R. orbited the first man-made satellite around the earth. Like other famous innovations, the exploration and investigation of space has been hailed as mankind's loftiest expression of his search for ultimate truth, and simultaneously it has been damned as an expression of man's evil preoccupation with his own self destruction. It is up to all of us, citizens of all countries, to make certain that the first, not the last, of these predictions comes true.

Radio amateurs, joined in brotherhood by their unique, world-wide, non-political hobby are in an enviable position to help make this optomistic prediction come true. We are scientific-minded and open-minded; we converse freely among ourselves; we are non-political in nature; and, we enjoy a place in the sun unequalled among other hobbies.

It is right and just, therefore, that the radio amateur seizes this golden opportunity to enhance the peaceful space activities for the welfare of all humanity, regardless of the amateur's political hue or belief. The radio amateur assumes this duty seriously, for he represents the civilian's interest in space. The radio amateur is non-military and non-political, and he proudly stands unencumbered by restrictive labels or by prescribed concepts. Above all, amateur radio is the hobby of tomorrow. It is an eternally young hobby, encompassing the youth of today who will be the engineers, leaders, and builders of our future.

The grim picture of the space scientist as a designer of deadly rockets and missiles is surely not an encouraging one to present to the future generation. The other side of the coin—the peaceful exploration and use of space for mankind's benefits—is one that does not conflict with moral and social standards at odds with quick destruction. This side of the coin has great merit, yet its quiet, and valuable contributions to mankind are often lost in the loud din of missile and rocket advancement. Surely we must present a picture other than death and destruction—some other goal than continued warfare—to our children, or we have failed our trust.

An understanding of profound social changes, helping to fit the space program into a balanced program with other competing national and international social efforts, and the broadening of man's horizons are a worthwhile civil effort in which all can study and contribute their part. Amateur radio can and *must* be a leader in this undertaking.

Amateur radio is the great stepping stone to science and electronics and the related fields for thousands of young people, and has been so for decades. Why cannot this hobby serve as a similar stepping stone for the future space scientists and space communicators? The answer is: It can! Radio amateurs can lead the civilian way into this new and unique exploratory field. They can illuminate and emphasize the value of a career in this field. They can serve as an introduction and preliminary training ground for tomorrow's engineer, as well as for today's generation of radio amateur operators. Thus amateur radio continually serves in the best interest of us all—serving the public interest, convenience and necessity.

To expand, implement, and extend amateur radio on a world-wide basis is the primary purpose of Project OSCAR. The furtherance of amateur radio will serve our best interest, and

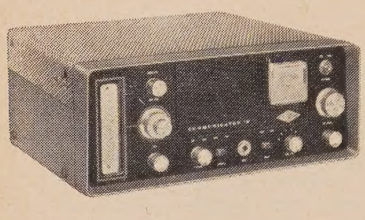
[*Continued on page 18*]

OUR COVER

WE think this month's cover adequately represents the interest conjured up by the OSCAR launch on December 12, 1961. General Curtis Le May, K4RFA and Tom Brushart, KN3LRA share a tense moment during one of OSCAR's passes over Washington, D.C. Latest report is that OSCAR signals faded during its 325th orbit of the earth, on January 2, 1962.

The complete line of Gonset Amateur Equipmer offers superlative performance at moderate co

COMMUNICATOR IV—2 METER TRANSCEIVER



Completely new — inside and out! Transmitter power greater than ever at 24 watts input. High level speech clipping and 10 watts of audio insure full talk power! Transmitter is crystal controlled, offers choice of six frequencies. Broadband circuitry in driver eliminates panel controls.

Receiver uses latest frame grid VHF tubes in RF and mixer for low noise figure of 4-6 db, triple conversion with crystal controlled first conversion . . . excellent sensitivity, selectivity. Also automatic noise limiter, adjustable squelch, "S" meter, slide rule-type dial, panel speaker. Built-in power supply operates on both 115V AC and 12V DC. DC supply is transistorized, eliminates vibrator. Power cables are supplied for shift from AC to DC. Size: 5" H, 12½" W, 11" D. Weight, 21.8 pounds.

DC operation is with negative ground only.

Less Microphone Model #3341 Amateur Net.....369.50

COMMUNICATOR IV—6 METER TRANSCEIVER

Communicator IV for 6 meters is the same size and general appearance as the 2 meter model. Tunable receiver covers 49.9 to 54.1 with the 50-51 mc range spread over one third of the dial range. Receiver is triple conversion type, has sensitivity of 1.0 μv for 10 db (S+N)/N or better. Noise figure is 6-8 db.

Transmitter operates at power input of 24 watts, has six crystal control positions with socket for external VFO.

Crystals are in the 8.333 to 9 mc range. Equipment has push-to-talk provisions.

2-way power supply, 12V DC and 115V AC is built in. DC supply is transistorized, operates negative ground only.

Less Microphone Model #3342 Amateur Net.....349.50

COMMUNICATOR IV—1¼ METER TRANSCEIVER

The first commerically-produced "package" operating on the amateur 220 megacycle band! Operates at an input power of 20 watts—substantial for VHF—incorporates an excellent superheterodyne receiver.

Triple conversion receiver is continuously tunable over the frequency range of 219.7 to 225.3 mcs. To comply with OCDM requirements, additional provision is made for spot frequency reception on one crystal controlled frequency. Receiver sensitivity is 1.0 μv for 10 db (S+N)/N ratio. Noise figure is 6-8 db, exceptional for equipment of this general type. Adjustable squelch and ANL are included.

Transmitter is crystal controlled, offers choice of 6 frequencies. (Required crystals are within the range of 8.143 to 8.333 mcs.) Provision is made for external VFO. Power input to PA is 20 watts, amplitude modulated by P-P 6BQ5's operating in Class AB1. High level speech clipping and audio shaping are incorporated.

Unit is identical in size and general appearance to the Communicator IV 2 meter model. 2-way power supply for 115V AC and 12V DC (negative ground) is built in.

Less Microphone Model #3351 Amateur Net.....394.50

VFO FOR 6, 2 AND 1¼ METER COMMUNICATORS

New VFO is designed for use with all Gonset Communica including Models I, II, III and IV. Dial scale is calibrated 50,144 and 220 megacycle bands. Microphone connector w FM modulator is provided to allow VFO to be used for Nar Band FM. Excellent stability.

Model #3357 Amateur Net.....69

GSB-201 SSB RF LINEAR AMPLIFIER

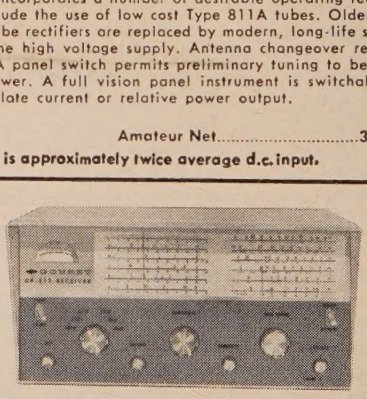
This entirely new linear amplifier is exceptionally compact— is only 8½" high, 12⅝" wide and 17" deep—lends itself readily to table-top mounting. It is finished in blending ligh colors, presents a handsome clean-cut appearance.

The linear amplifier covers 80, 40, 20, 15 and 10 mete amateur bands, incorporates full bandswitching, has pi network output. Power input rating is 1500 watts PEP SSB*, 1000 watt CW, 400 watts AM. This amplifier can be driven by exciter in the 65-150 watt category, GSB-100 and similar units. Stable grounded-grid circuitry is used.

GSB-201 incorporates a number of desirable operating feature which include the use of low cost Type 811A tubes. Older typ vacuum tube rectifiers are replaced by modern, long-life silico types in the high voltage supply. Antenna changeover relay i built-in. A panel switch permits preliminary tuning to be don at low power. A full vision panel instrument is switchable t indicate plate current or relative power output.

Amateur Net.....399.5

*PEP input is approximately twice average d.c. input.



GR-212 DUAL CONVERSION RECEIVER

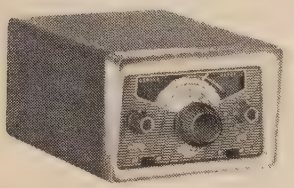
Dual conversion for increase selectivity. Variable BFO. Se tivity: At least 6 db (S+N)/N at 1 μv (mod. 30% at 400 input on all H.F. Bands. Two full-vision, illuminated, slide-r type dials provide instant identification of broadcast and sh wave frequencies. Panel-mounted "S" meter. Band-spr tuning knob is inertia fly-wheel weighted for smoothest tuni Separate band-spread dial for amateur bands. For 115V operation.

Amateur Net.....99

GR-211 ALL BAND RECEIVER

imilar in appearance to the GR-212. General coverage from andard broadcast through 34 mc band, including WWV, reign & Voice of America. Printed circuit techniques and dvanced design for extra sensitivity, better, quieter reception, ven on highest frequency bands. 5 tubes, two solid state recti- ers. TRANSFORMER-POWERED (not ac/dc) for higher over-all ain, better signal-to-noise ratio. Circuit features leading to gher sensitivity include quality, high-Q, permeability-tuned ils. Two full-vision, illuminated, slide-rule type dials provide stant identification of broadcast and short-wave frequencies. rnier tuning knob counter-weighted for smooth, non-critical ort-wave tuning. For 115V AC operation.

Amateur Net.....69.50



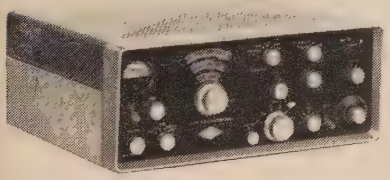
SUPER 12 SIX-BAND CONVERTER

per 12 provides coverage of 6 amateur bands: 10, 15-20, 40 d 75 meters plus 19 and 49 meters for coverage of inter- tional shortwave broadcasts. Calibrated dial scale uses ious colors to aid in identification of bands. Planetary drive ovides vernier tuning.

nsitivity and stability are excellent. Antenna trimmer on nel maximizes antenna in use. BC-HF switch permits instant urn to standard BC. Super-12 is attractive . . . blends well h instrument panel of modern cars. Compact size facilitates unting. Highest quality components and precision workman- p ensure long, trouble-free operation. Installation is simple, n-technical — no alteration or internal connections to existing oadcast receiver. Converter simply patches into antenna input nector of car radio . . . attaches to 12 volt accessory post ler dash. Install in minutes with ease.

12 volts DC neg. ground only.

Amateur Net.....89.50



-76 ALL BAND TRANSCEIVER FOR FIXED OR MOBILE SERVICE

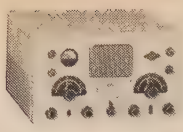
6, an entirely new unit consisting of transmitter and receiver single compact housing. Provides AM or CW operation on 40, 20, 15, 10 and 6 meter amateur bands. The G-76 rporates proved design features of the famed Gonset 6/G-77 "Twin sparklers," adds many new advances for fixed station and mobile operation.

iver is dual-conversion with 1st 1-F at 2065 kcs, 2nd 1-F 62 kcs. Features include BFO for SSB and CW reception — matic noise limiter. Unit has excellent selectivity and sensi- y. Transmitter and receiver oscillators are temperature com- ated. Transmitter has stable VFO for all bands except 50 which is crystal control only. Crystal control of other ls is optional. Power input to transmitter is 100 watts AM, e, 120 watts, CW. Final tube is 6DQ5 operating into pi ork output. Control is push-to-talk or by T-R switch on l. Meter facilitates tuning, acts as "S" meter on receive. ensions: 12½" W, 5" H and 10½" deep. Unit has internal t for crystal calibrator (optional) also panel switch for rator operation.

nd DC power supplies are available as accessory items at 00.

Amateur Net.....399.50

G-50 6 METER FIXED STATION COMMUNICATOR



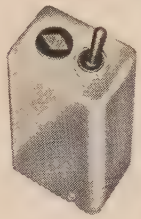
G-50 is a complete station "package" for 6 meter operation. Receiver is highly sensitive, selective superhet with "S" meter, ANL, adjustable squelch, panel mounted speaker. Transmitter uses 6146 in pi network final at 40-50 watts input. Frequency control is by crystal or built-in highly stable VFO. Latter gangs with multiplying stages, eliminates excitation controls. Dial is calibrated 50-54 mcs. Modulator uses two 6L6GB's. Compact housing, 7½" H, 13" W, 12½" D contains receiver, transmitter, power supply. For 115V AC operation.

Amateur Net.....319.50

CD MODEL. Similar in general appearance to standard amateur model but is certified as meeting applicable specifications under OCDM U-68. Cabinet is same size as amateur model, has appropriate CD markings. Mic. and crystal certificate included.

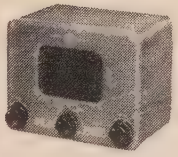
Model #3300-CD Amateur Net..... 349.50

NOISE CLIPPER



Designed for use with either mobile or fixed receivers that utilize the more common types of second detector. Reduces such interference as ignition noise, certain types of power leaks, and other forms of "Pulse" type noise having a low repetition rate and short pulse length. Utilizes a miniature diode in a form of series gate. Easy to install. Complete instructions furnished.

Model #3001 Amateur Net.....11.95



MONITONE

For use as a code practice oscillator and as an effective monitor for phone and CW xmtrs. Has audio oscillator controlled by external circuits, provides audible tone on panel speaker or earphones. Separate pitch and volume controls. Uses RF pickup from xmtr. for operation as effective CW or phone monitor. Operates from 115 VAC with isolating circuitry so that neither keying nor earphone leads are "hot" to ground.

Model #3022 Amateur Net.....29.50

GC-105 "GOONEY BIRD" COMMUNICATOR

Silicon diodes to save current drain . . . calibrated tunable receiver utilizes low-noise 6BZ8 RF tube sensitive in "Cascode" circuit. AVC is applied to avoid possibility of blocking by strong local signals. Special gang-tuned circuits give high image rejection. Dual purpose meter automatically switches from relative signal strength to relative output. Increased modulation capabilities with high level clipping. All tunable circuits controlled from front panel. Tune-up procedure simplified by use of broad-banded exciter stages. Completely compatible with Gonset's new model 3357 VFO or 6 crystal positions available. Input: 6/12 DC or 115 AC volt operation, power cables supplied. Output: 6 watts nominal. Dimensions: 6½" high, 15½" wide, 8" deep.

Amateur Net.....239.50

For further information on Gonset products see your nearest Gonset Distributor or write to —

GONSET®

DIVISION OF YOUNG SPRING & WIRE CORPORATION

801 SOUTH MAIN STREET, BURBANK, CALIFORNIA

For furtehr information, check number 8, on page 118

WIN almost $2000.00

in mobile equipment

NEW-TRONICS

"What's My Handle"

MOBILE ANTENNA CONTEST

FIRST PRIZE

COLLINS KWM-2 TRANSCEIVER

COLLINS MP-1 POWER SUPPLY

COLLINS 136B-2 NOISE BLANKER

COLLINS 351D-2 FLOOR MOUNT

NEW-TRONICS BUMPER MOUNT

NEW-TRONICS NB-40 NOISE BLANKER ANTENNA

COMPLETE ANTENNA KIT FOR 10-15-20-40-75 METERS

10 MOBILE ANTENNA ASSEMBLIES WILL BE GIVEN AS CONSOLATION PRIZES

To help you select a "handle" examine the features of the assembly illustrated and described on the opposite page.

Entry blanks and contest rules available at electronic distributors. If your distributor doesn't have entry blanks ask him to get them or write us and we will send them to you.

Nothing to buy! Contest closes March 1st, 1962.

NEW-TRONICS DIVISION 3455 Vega Avenue Cleveland 13, Ohio

For further information, check number 9, on page 118

NOW YOU CAN WORK

10-15-20-40-75 bands mobile with one mount . . . one mast . . . one lead and band matched (center loaded) resonators.

NEW-TRONICS

new antenna assembly

A new, efficient concept of center loading.

Buy only what you need—one mast and the resonators for the bands you work.

The 54-inch fold-over, heat treated aluminum mast allows the resonators to be interchanged conveniently in seconds. This feature also makes it possible to lower the assembly to clear openings in garages, carports, or low overhanging obstructions. When opened to full height, the two sections of the permanently hinged mast are rigidly held in place by a shake-proof sleeve clutch arrangement.

One mount . . . one feed line . . . one mast and a selection of resonators enable the "ham" to operate mobile with unprecendented results on any of the five popular bands. "Hams" who have field-tested these antennas are enthusiastic about the results they get out of their mobile rigs regardless of the equipment they use or the bands they work.

SWR less than 2 to 1. Power rating: AM, dc input 75 W; SSB, dc input 150 W.

Total antenna length varies between 75″ and 97″ to cover all bands.

Mast and each resonator may be purchased separately. Mast fits any standard mount.

MO-1	Mast—Folds 15″ from base . . .	Amateur Net $ 7.95
MO-2	Mast—Folds 27″ from base . . .	Amateur Net $ 7.95
RM-10	10 Meter Resonator	Amateur Net $ 5.95
RM-15	15 Meter Resonator	Amateur Net $ 6.95
RM-20	20 Meter Resonator	Amateur Net $ 7.95
RM-40	40 Meter Resonator	Amateur Net $ 9.95
RM-75	75 Meter Resonator	Amateur Net $11.95

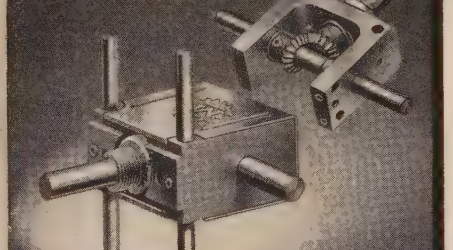
Get all the technical information at your distributor or write for literature.

NEW-TRONICS DIVISION
3455 Vega Avenue
Cleveland 13, Ohio

For further information, check number 10, on page 118

Designed for

Application



The No. 10012

RIGHT ANGLE DRIVE

"Designed for Application." Extremely compact. Case size is only 1½" x 1½" x ¾". Uses bevel gears. Mounts on adjustable "standoff rods," single hole panel bushing or tapped holes in frame. Ideal for operating switches, potentiometers, etc., that must be located, for short leads, in remote parts of chassis.

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Letters..... to the Editor

TKS

Editor, *CQ*:

Just a word regarding awards based on two recen actions by your magazine with the idea you welcom comment to know we at least read what you thin and print.

First: your editorial in the November issue abou what should count. You have the foresight to realiz that with bands fading out, the local awards are com ing into strong favor. They give the low power boy something to set their sights on. However, it can an is being overdone. Your excellent awards manage K6BX is limiting listings in the *Directory* to award sponsored by clubs. Many so-called "trash" awards di a fast death. A certificate for "Worked Maw, Paw an Junior" are a joke, if credit is given for an *earne* award. I agree, where should the line be drawn? How ever, I do not go along with the League in puttin awards on an International approval basis.

Second: My compliments to you in having "Mi Certificate," K6BX, handle your USA-CA award. Con gratulations on the WPX rule changes. Awards shoul be for the individual *not* the station. Elimination requirement for sending a two-pound bundle of car is a fine move. Requiring representative cards on re quest, prevents forged lists and keeps control of wha might become a bad situation. As sponsor for th "20-K" award for working 20 different K-prefix over seas bases, I have found little trouble; mostly a mi understanding of rules, such as the W6 who sent te statewide K prefixes.

Unless we let you know how your suggestions an actions are received it is difficult for you to satisfy th majority for the good of ham radio. Please accept m contribution in the spirit in which it is given.

Lauren L. McMaster, W1AGS, ex-K2QX
P. O. Box 1145
Weston, Conn.

C.W.??

Editor, *CQ*:

What has tappened to c.w. in this area? It's a shame I've been set up here seven months and I have onl heard four c.w. stations operating. Can't we stir thi up a little? Is it all these guys have to do is lear enough code to get the license and forget it?

Let me put it this way. It doesn't take too muc intellect to use your mouth. How's about a punch fo c.w.—its fun! No one to ham with,

W. E. Wilkinson, K6LB
805 Pismo Court
San Diego 8, Calif.

Contests

Editor, *CQ*:

It was of interest to read the letter by W8GIU i October 1961 *CQ*, but in spite of it I'll still pitch i my vote for contests.

As I see it, they don't interfere with any othe branch of ham activity and for those of us who ar pretty busy in our vocations it gives us a chance t test out our gear, to renew acquaintances, to get i some concentrated activity and to contact "anothe country".

After the contest is over it seems to me to be th reasonable thing to send in a log for checking purpose —it adds to the interest to see how many of the leade I managed to contact.

←For further information, check number 11, on page 1

Fabulous

value

BY HAMMARLUND

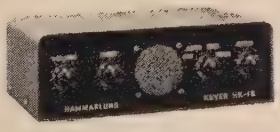
the exciting, low cost

HQ-100A

$189.00 AMATEUR NET

NOW—even better CW and SSB reception with the NEW HQ-100A. Modern, up-to-the-minute design has resulted in extra convenience and superb performance by providing independently controlled, continuously variable BFO and Q-Multiplier—permitting simultaneous use of both. CB listeners can use a handy citizens band channel marker—usable at your option—and provided at no extra cost.

You just won't believe the CW and SSB reception afforded by this unit. See and hear it at your local Hammarlund Distributor and convince yourself that the HQ-100A is indeed a FABULOUS VALUE.



"Personal Touch" Electronic Keyer—HK-1B

Half the price—twice the value. Fully comparable to keyers costing twice as much. Individual dot/dash control, automatic, semi-automatic (bug) or straight key operation. Guaranteed Hammarlund quality at the lowest cost ever. **$39.95** (less battery)

24 hr. Clock-timer $10. optional
XC-100 Crystal Calibrator optional $15.95

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53 West 23rd Street, New York 10, N.Y.

Established 1910

For further information, check number 12, on page 118

NOW!
TWO ANTENNAS IN ONE*

*another FIRST from FINCO

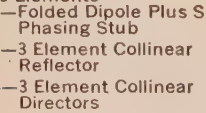
Patent RE 24,413
Other patents pending
6 & 2 Meter
Model No. A-62
Amateur Net A-62 $33.00
Stacking Kit AS-62 $2.19

The Only Single Feed Line
6 & 2 METER
COMBINATION YAGI ANTENNA
from FINCO

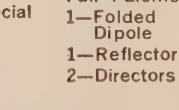
- Heavy Duty Square Aluminum Boom, 10 Ft. Long
- All Elements are Sleeve Reinforced And Completely Pre-assembled With "Snap-Out" Lock-Tite Brackets
- Boom Suspension Rods Are Supplied Completely Pre-assembled, Ready To Be Snapped Into Upper End Of Mast

ON 2 METERS:
18 Elements
1—Folded Dipole Plus Special Phasing Stub
1—3 Element Collinear Reflector
4—3 Element Collinear Directors

ON 6 METERS:
Full 4 Elements
1—Folded Dipole
1—Reflector
2—Directors



A6-4 6 Meter 4 Element
Amateur Net $17.16
Stacking Kit AS-6 $2.19



A2-10 2 Meter 10 Element
Amateur Net $11.88
Stacking Kit AS-2 $1.83

A1¼-10 1¼ Meter 10 Element
Amateur Net $11.88
Stacking Kit AS-1¼ $1.26

See Your FINCO Distributor
or write for Catalog 20-226 to:
THE FINNEY COMPANY
Dept. 19, 34 W. Interstate St., Bedford, Ohio

For further information, check number 13, on page 118

There is room for all of us and there is no dou that the concentrated activity at contest time is a stron weapon in the hands of our representatives who ha to battle at the I.T.U. Conferences to save our band

Perhaps one solution to "GB's" problem would to appoint his XYL as his QSL Manager and he wou then leave the pasteboard problem to her and spen his time "plugging away."

Dr. A. W. Lewis, ZL3R
P. O. Box 50, Kaiapoi,
New Zealand

Short Wave Listeners

Editor, *CQ*:

Three or four years ago an s.w.l. department w proposed in *CQ*. I have been s.w.l.ing for two yea and read every copy of *CQ* that I can find. I belie that time has come for the s.w.l. to again raise h voice in a fight for a place in *CQ*, to tell others th "the ham in EP-land QSLs 100%, etc."

In my two years, I've received 73 QSLs, 59 of the are from amateurs; of these, 35 states including KP KX6, I1, ZE6 have been confirmed.

Another thing, *CQ* in its present state is leani toward s.w.l. whether it is noticed or not. Let me e plain what I mean. Contests! What better time is the to snag rare DX? Almost all contests of any impo tance are announced in CONTEST CALENDAR. "DX gives details on who's working what, where. It al gives details on some awards s.w.l.s can get. So wh I'm asking for is just an extension of your prese good will. Also I was wondering if you will awa HAZ (Heard All Zones), HPX, or your USA-CA a heard basis?

Roger Williams
Route 2, Box 7
Snohomish, Wash.

USA-CA is offered on a heard basis and s.w.l.s ha already qualified—See USA-CA section.—*Ed.*

Digital Calling

Editor, *CQ*:

I read with interest the suggestion in *CQ* so months back for a National Calling Frequency in ea band. It has given me an idea for an automatic calli system.

Each station set up for automatic calling would assigned a 25-bit binary call number. Calls to transmitted would be set up by switches, or in t case of often-called ones, by means of metal or plas keys notched with the digits. A start pulse of 2½ stan ard pulse widths would be transmitted, followed 2½ pulse widths of silence, and then the call itself. clock motor would drive a commutator to generate t motor would drive a commutator to generate t pulse train at about 30 p.p.s. The signal would picked up by a simple receiver, crystal-controlle which would be left on at all times. The start pul would start a commutator at the receiving end generate the station's code, and this would be co pared to the incoming signal. Any discrepancy lasti more than 1/5 of a pulse-width would reset a flipfl set by the start pulse. If the flipflop was still when the receiving commutator completed its revol tion, the alarm device would operate. A refineme would be the addition of a CQ code and some ar CQ's, which an individual receiver might-or-might-n be equipped to decode. Another possibility would a magnetic drum to record everything on the calli frequency for five seconds after an alarm, so that t calling station's call and listening frequency could sent in high-speed c.w.

No special transmitter would be required, since p.p.s. is about the same keying rate as 50 w.p. Just put a calling frequency crystal in the rig.

A system of this sort would do two things. It wou cut the calling time, including callback informatio to three seconds or so, with no reply at all on t calling frequency, except when the station called unable to call back near the specified frequency. T would get many more calls per minute out of a sin frequency perhaps making it possible to get most

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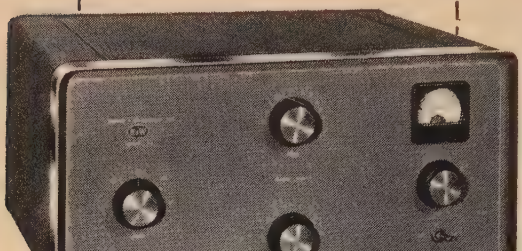
CQ-85

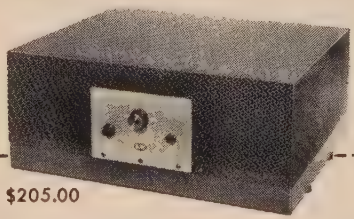


PRICE $375.00

FOR THE ULTIMATE IN POWER...
LPA-1 GROUNDED GRID LINEAR

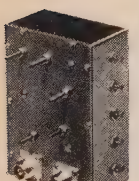
Ready for a full kilowatt? Here's the power package for you. The B&W LPA-1 is new, skillfully engineered to give you *everything* you need in an amplifier. Two Type 813 beam power tetrodes, connected as high-mu triodes in a grounded grid circuit . . . flexible Pi-network output circuit with precise adjustment of tuning and loading 80 through 10 meters . . . smart, functional styling.

The LPA-1 takes no more space than a receiver, but what a difference it makes in your signal.



PRICE $205.00

The LPS-1, a compact high voltage power supply for the LPA-1. Removable switching control panel lets you use it side by side or remotely. Heavy duty components for continuous operation ... full wave single phase bridge rectifier using four Type 816 tubes...R.F. filtering.



Compact LPA-MU impedance matching unit for driver-exciters with fixed output impedance or marginal output. Couples to bandswitching Pi-network of LPA-1 for automatic input matching. Similar unit, LPA-MU-2 for B&W amplifiers L-1000-A and L-1001-A.

LPA-MU $36.00
LPA-MU-2 $36.50

See these new units at your B&W dealer soon, or write for color brochure.

Barker & Williamson, Inc.
Canal Street & Beaver Dam Road
Bristol, Penna.
P.O. 7530 Ad No. 1.17

For further information, check number 15, on page 118

the calling traffic on one or two frequencies, say 20 and 40. The system would also make it possible to call any station without a schedule, as long as the band is open.

This, of course, would not kick the other modes off the frequency. Anyone wanting a ragchew would still do well to turn on the speaker and listen for a CQ.

A unit used on a net frequency and set up to trigger the receiver's squelch circuit could eliminate the necessity of listening to the net. The receiver would come on automatically for addressed transmissions and QNC's. It would be a matter of pushing in a key for a particular station and talking.

The single-transmission principle, in which the calling station identifies and specifies a reply frequency, could also be used to speed a.m. and c.w. calling. Comments, anyone?

John A. Carroll, K6HKB
Box 453 Occidental College
Los Angeles 41, Calif.

This sounds like an excellent idea but undoubtedly is in violation of SEC. 12.105—*Ed.*

East Coast V.H.F. Dinner

The 4th Annual Dinner/Hamfest sponsored by the East Coast V.H.F. Society will take place on Saturday, February 24 at the Swiss Chalet; Ramsey Circle, Route 17, Ramsey, N. J. Tickets at $5.00 per person may be obtained in advance *only* from Jack Tompkins, K2HHS, 135 Herbert Terrace, Saddle Brook, N. J.

Hospitality

R. L. Gunther, W6THN/1, c/o Biology Dept., Brown University, Providence 12, Rhode Island is anxious to hear from anyone contemplating a visit to Europe, or vice versa. He is the U. S. Representative for the International Ham Hop Club which does a fine job of making foreign amateurs feel at home during trips abroad.

W2SAW

Speaking of trips abroad, Sax Ringler, W2SAW, famous DXer and the gentleman running the DX Stamp Service, is making a trip to Europe early this year. He will visit many radio clubs and lecture on amateur radio operation in the U.S.A. All amateurs are requested to send Sax color slides of their rigs, antennas, etc., so that he may illustrate his talks. Slides will be returned if requested. His QTH is Webster, N. Y.

Directory

Do you have the Bible of Ham Certificates? K6BX will supply all info via Box 385, Bonita, California.

Burma

The Burma Amateur Radio Transmitting Society would like everyone to know they have changed their name from the Burma Amateur Radio Society. The address has also been changed to P. O. Box 800, 95, Maung Tauley St., Rangoon. Officers for 1962 are: President, XZ2ST; Vice Presidents, XZ2AD and XZ2MM and Secretary, XZ2SY.

Rochester A.R.A.

A Valentine Dinner Dance is scheduled for Saturday evening, Feb. 10th at the Manger Hotel in Rochester, N. Y., sponsored by the Rochester Amateur Radio Association. Information and tickets at $4.00 per person are available from Harry Smith, WA2KND, at 153 Mason Ave., Rochester 15, N. Y.

QCWA

Ralph Barber, W2ZM, Executive Secretary of the QCWA was the first member to win the QCWA class

[*Continued on page 95*]

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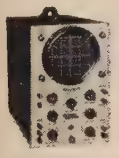

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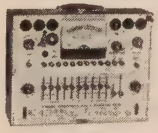

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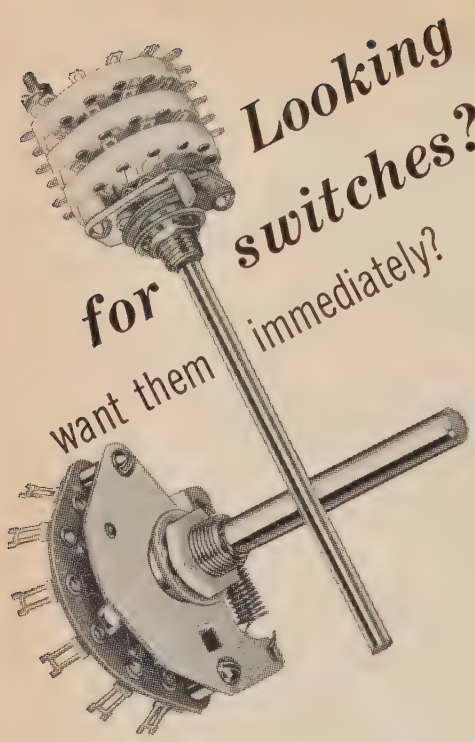

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Zero Bias [*from page 7*]

will, in this instance, be accomplished by means of space satellites and space communication projects. Thus the radio amateurs of the world, in effect, represent the *civilian interest in space,* and will introduce the civilian to the problems and studies of this new field of exploration.

Project OSCAR is "of, by and for the radio amateur." To elaborate: It is non-profit, non-military, and non-political. It exists for the love of the hobby, the desire of knowledge, and the drive for self-education that exists within every radio amateur.

Project OSCAR will accomplish the basic aim of this project in three steps:

1—To project an experimental amateur signal into space. The launch of OSCAR I on December 12, 1961 has made this a reality.

2—To simultaneously establish an organization and mode of operation that will make full use of information gained from the experiments. The OSCAR Association fulfills this role.

3—To establish some form of amateur repeater equipment in space which can be used for experimental communications. Amateur radio is essentially a hobby of *communication* between individuals, and the ultimate goal of normal amateur activities is person-to person communication. This step remains to be done.

The first and second steps are at hand. What are the immediate objectives?

a—The first flight (OSCAR I) serves to introduce large numbers of radio amateurs, science clubs, and high school science groups to an amateur-band, amateur constructed outer space signal. This provides the impetus for an intensive self-education and self-training program covering the techniques of utilizing satellite transmissions for investigative purposes. In effect, this is the first tangible instance of a direct, civilian space effort on a vast scale.

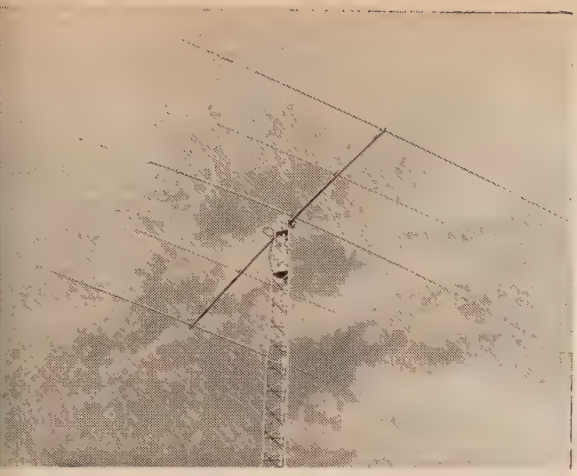
b—The first flight will exercise large numbers of amateurs in the art of data handling and interpretation. It will raise the technical standards of the participants and at the same time immerse them in a world-wide common undertaking of benefit to all amateurs, having prestige for the cooperating parties.

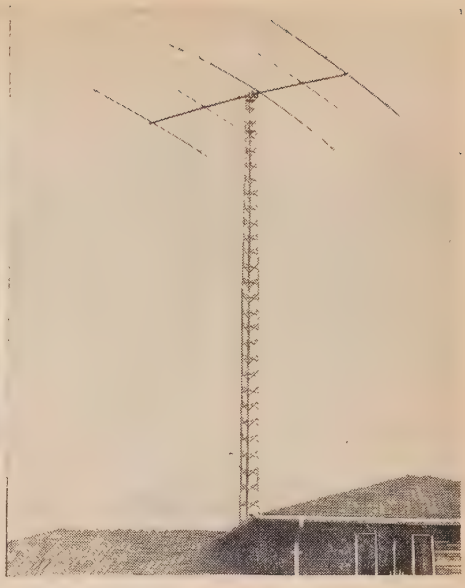
c—The first flight will stimulate the assembly and operation of countless amateur tracking stations. Many of these will be in areas, inaccessible to formal tracking stations of this (and other) Governments. A large number of such stations can gather data in a quantity that is impractical to achieve by any means other than voluntary effort.

d—The first flight will stimulate design and construction of advanced state-of-the-art electronic units for the use in space equipment and in ground stations. A technical self-education program is already well underway, conducted through the radio amateur magazines.

e—The first flight exercises and enhances the capability of existing amateur radio communica-

[*Continued on page 95*]





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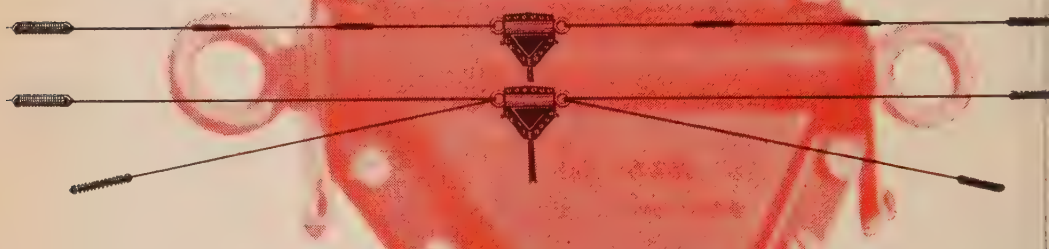

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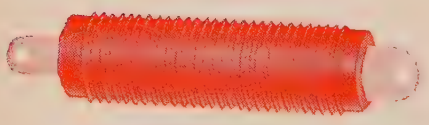

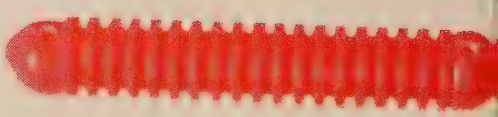

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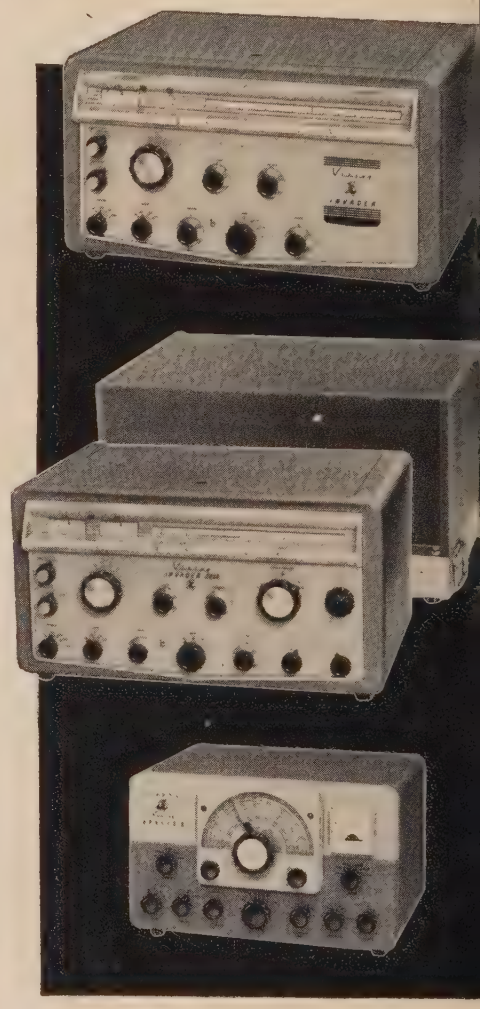

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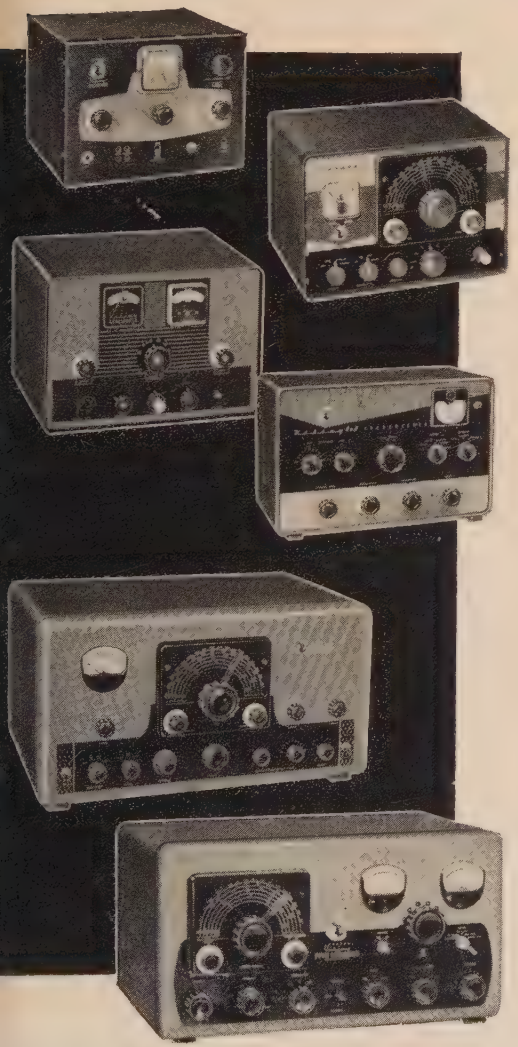

ADVENTURER—Self-contained . . . 50 watts CW input . . . rugged 807 transmitting tube . . . instant bandswitching 80 through 10 meters. Crystal or external VFO control—wide range pi-network output—timed sequence keying. With tubes, less crystals.

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Cat. No. 240-126-1 Kit—Amateur Net . . $149.50

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CHALLENGER—70 watts phone input 80 through 6; 120 watts CW input 80 through 10 . . . 85 watts CW on 6 meters. Two 6DQ6A final amplifier tubes. Crystal or external VFO control—TVI suppressed—wide range pi-network output. With tubes, less crystals.

Cat. No. 240-182-1 Kit—Amateur Net . . $114.75

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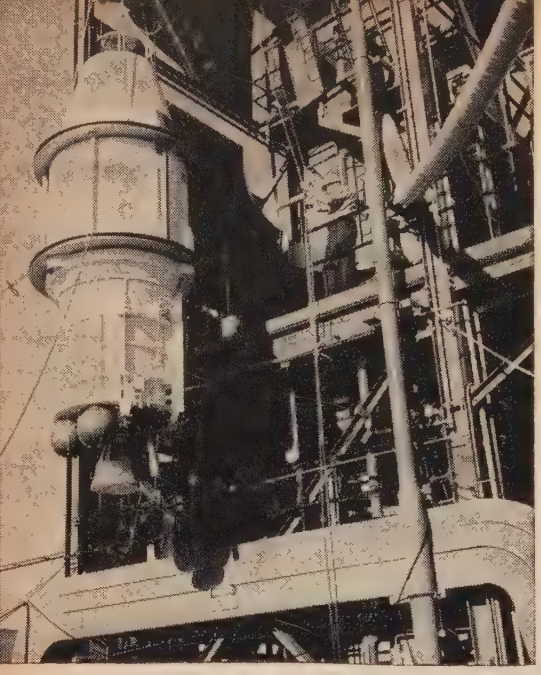


The Agena booster, which sent OSCAR into orbit on December 12, undergoing preflight tests at Vandenberg A.F.B. The OSCAR package was installed in the aft ribbing of the airframe directly above the round fuel tanks.

PROJECT OSCAR: A REPORT

BY DONALD L. STONER*, W6TNS

Launch Details and Technical Data

On December 12, 1961, amateur radio entered the space age! The following two articles, written by W6TNS and W3ASK, both contributing editors of *CQ*, highlight the inside story of the OSCAR launch aboard the Thor/Agena vehicle and the technical problems encountered over the past year. A brief summary of the history of the Project OSCAR Association is presented and the possibility of future OSCAR launchings is discussed.

Both the SPACE COMMUNICATIONS and VHF sections have been deleted this month to bring you this special report on Project OSCAR. They will return as usual in the March issue.

THE day was November 13, and I had just arrived at the Lockheed facility in Sunnyvale, California. One of my first impressions was the heavy air of excitement which permeated the atmosphere. I recall that everyone connected with Project OSCAR had a bounce in their step and one found it infectious. No explanations were necessary; from the broad smiles and excited gestures, it was obvious that the OSCAR flight date was imminent. I must admit that I had not realized the magnitude of the work being done until this visit with the OSCAR Committee.

It is difficult, for someone who has not seen it, to conceive of the activity that resulted from the exchange of correspondence between Fred Hicks, W6EJU, and myself, a short time ago. Originally, Project OSCAR looked like a "pipe dream", just something to kick around. Then slowly, almost imperceptibly, it grew out of the realm of remote possibility and became transformed into a well organized team all working toward one goal—the ejection of an amateur radio satellite into orbit.

I cannot praise too highly the people connected with Project OSCAR. It has been estimated that some 40,000 man-hours were contributed to the project. No one has received any compensation for their efforts other than the reward of making a significant contribution to the amateur fraternity.

Every nut, bolt and electronic component for OSCAR was scrounged from scrap piles and abandoned equipment. These parts were molded into a working satellite by hundreds of highly skilled people working on their lunch hours and on many occasions, late into the evening.

The first day at Sunnyvale was spent "getting the feel of things". Essentially this meant acquiring the same spirit that radiates from the people connected with OSCAR. It required about 15 minutes to infuse and then one started looking around for jobs which need doing. The first order of business was to travel with the Air Force photographers in an effort to document, for posterity, the many aspects of OSCAR. Even the Air Force people, who see satellites and missiles every day, seemed to realize that OSCAR was not just another "box" to capture on film before it is sent into the cold impersonal nothingness of space. They did

* VHF Editor, *CQ*

an outstanding job, under the most unusual working conditions (2 A.M. in the morning!) and as a result, ham radio received superb publicity in the press and television media.

The Radio Clubs

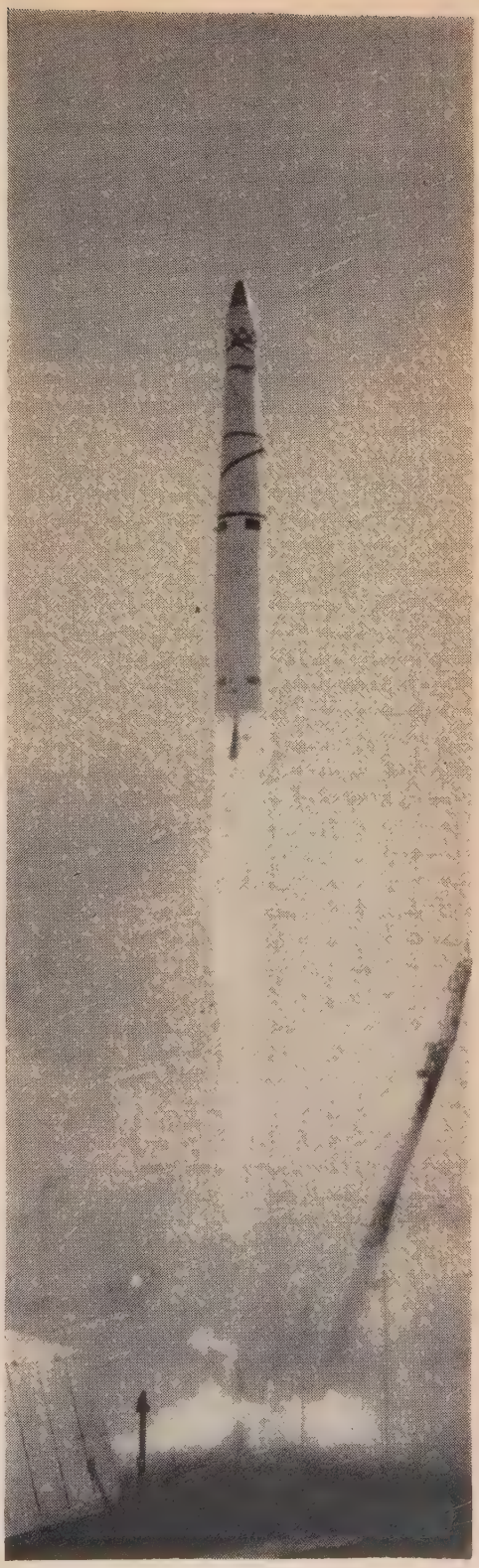
The participation and organization of the associated radio clubs was something to behold. Each member had been assigned a job which was followed to its conclusion. It is a paradox that many of those dedicated workers did not hear OSCAR during its initial pass, for they were much too busy with their assignments!

Our first stop was at the baliwick of Tom Lott, VE3AGF/6, custodian of the Ampex Radio Club. The assignment of this club was the acquisition of incoming OSCAR data. The ham shack is situated in one of the many Ampex buildings, along with an excellent workshop where members can build and test their own projects.

The Lockheed Radio Club also assimilates data supplied by low frequency inter-and intrastate traffic networks. These reports are then relayed to the data processing center. Twenty and 40 meters is used to collect data from the several overseas amateurs equipped to receive the OSCAR transmissions. Reports are even received from the South Pole, where the KC4 amateur radio stations have been equipped for the project. The primary traffic mode is, of course, single sideband.

The data processing center for incoming reports is located at the Hewlett Packard Radio Club in Redwood City, California. This is the nerve center for the entire network and elaborate advance planning helped expedite tracking reports.

Much of the tracking and path-prediction work was done by the members of the Philco Western Development Lab Radio Club. The station there is a ham's paradise. Up on the roof are three long Yagi antennas mounted on a two rotor system for azimuth and elevation. These antennas are cut for 108 mc, 145 mc, and the telemeter frequencies above 216 mc. The most impressive array of all is the Trihelix installation. This antenna is used for primary tracking of projects and consists of several helix mounted on a billboard pedestal arrangement. Orientation of the antenna can be made completely automatic by tying it directly into the data computer.



A new era in amateur radio begins as a Thor boosted Agena-DISCOVERER satellite rises majestically towards space from its launching pad at Vandenberg, California at 12:42 P.M. PST, 12 December 1961. Riding piggy-back with America's 36th satellite in the DISCOVERER series was OSCAR, the 10-pound radio amateur satellite. Twenty-eight minutes later, radio amateurs at KC4USB, in the Antarctica, copied OSCAR's 145 mc beacon transmitter, establishing that the satellite was successfully in a polar orbit. This marked the beginning of the space-age for radio amateurs throughout the world. (*Official U.S. Air Force Photo*).

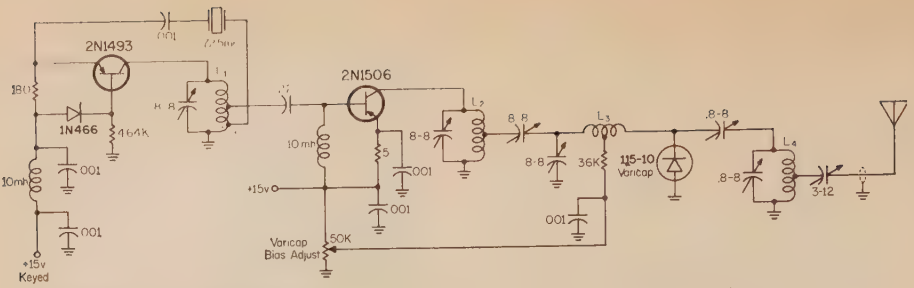


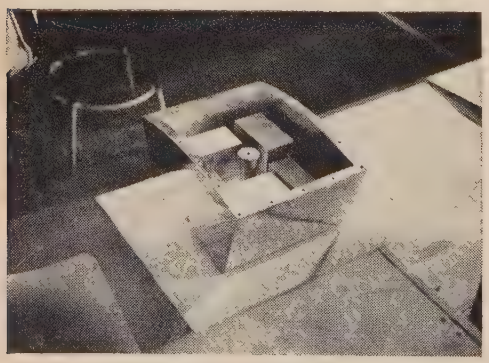
Fig. 1—Diagram of the transistorized transmitter used in the OSCAR payload. The circuit uses two transistors to drive a varicap diode. Output was approximately 150 mw at 145.000 mc. Keyed voltage was derived from the dot generator shown in fig. 2 on page 28.

Mechanical Details of OSCAR

After shooting pictures at the clubhouses, the next stop was the test center where OSCAR underwent the same rigorous tests to which other space experiments are subjected. Nick Marshall, W6OLO, technical director for Project OSCAR was preparing a package for test when we arrived.

Internally, the OSCAR equipment mounted on a magnesium plate, under four covers (see photo). The two larger boxes contained the mercury cells which made up the battery pack, while the HI keyer and 145.00 mc transmitter resided under the remaining two enclosures. These covers secured the equipment to the chassis plate and prevented contact with the encapsulating material. The chassis plate was secured inside the gold plated magnesium satellite package. The satellite was a pie-shaped container which measured approximately 10″ × 10″ × 6″ and was contoured to fit in the aft section of the bird. The cover of the package contained a fixture for the ¼ wave monopole which used the case as a counterpoise. The antenna was secured to the cover until after the transmitter separated from the parent vehicle. The satellite was mounted in the bird on a spring loaded squib which was fired in orbit. The energy stored in the compression-spring released the package at a velocity of five feet per second.

Once the chassis plate and container were mated and the unit tested for proper operation, the entire inside of the package was filled with a material called "Loc-Foam", which has the appearance of tiny solidified soap bubbles. This encapsulation material is light in weight and yet extremely strong. Its purpose is to eliminate vibrations and resonances and generally "beef up" the structure.



The OSCAR package just prior to encapsulation.

Environmental Testing

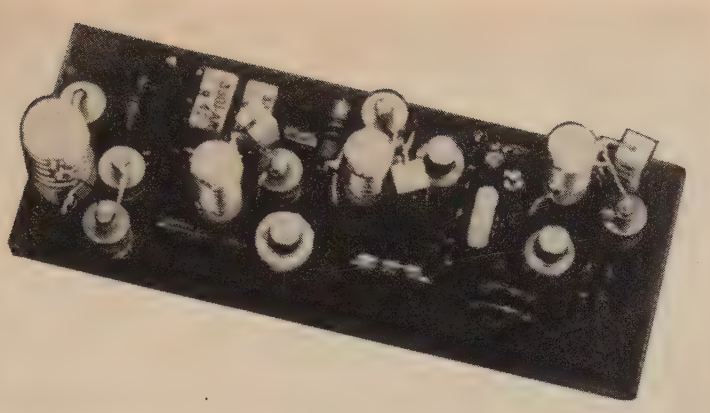
Testing of the completed package was, of necessity, quite rigorous to insure that it would perform satisfactory in space. During the original phases of the project, the technical section of the OSCAR Committee wrote a detailed set of specifications as to what the satellite should do and how this could best be accomplished. Next, a set of test conditions were formulated which the satellite would have to pass before it could be approved for space use. Finally, a test report was filed indicating that the package passed the tests and by how much.

At the test center, package number three was undergoing acceptance tests. The earlier units, of course, had been accepted and, in fact, had resided at Vandenberg Air Force Base since the summer of 1961.

The shock test, devised for the package, involved mounting the satellite on a fixture which is pounded by a huge hammer of known weight, from a specific distance. The transmitter was monitored, along with the G-forces which were indicated on an accelerometer attached to the package. OSCAR easily withstood a 50-G shock which far exceeded any anticipated disturbances which might be encountered during launch and separation phases.

Obviously there couldn't be anything which would move around inside the OSCAR package. This possibility seemed remote, particularly with the encapsulation, but to prove the performance under heavy G-forces, OSCAR was tested with a centrifuge. The transmissions were monitored during this whirling ride to detect any sign of erratic operation.

The final test for proof-of-performance was an altitude-temperature cycle. The package was placed inside an affair which had the appearance of a large rectangular oven. Once inside, the package was artificially subjected to great changes in altitude and temperature, such as those encountered in the void of space.



Photograph illustrating the layout of the 145.000 mc transistorized transmitter used in OSCAR. The "chassis" is fabricated of glass-epoxy resin and withstood a shock of 50Gs under environmental test.

OSCAR Technical

The OSCAR transmitter consists of a two-transistor r.f. generator driving a parametric diode connected in a frequency doubler configuration. The circuit for the OSCAR 1 transmitter is shown in fig. 1. An RCA 2N1493 is used as a common base oscillator, crystal controlled on 72.5 mc. Feedback occurs between a low impedance tap on L_1, the output coil and the emitter of the oscillator. Voltage for the stage is applied to the emitter and base through a click-filter from the keyer circuit. The 180 ohm resistor provides d.c. stabilization, while base bias is developed across the barrier potential of a silicon diode. R. f. output from the oscillator is applied to a Pacific Semiconductors 2N1506 n.p.n. 72.5 mc power amplifier. Coupling to this stage is through a 22 mmf capacitor tapped at a suitable impedance point on coil L_1. The amplifier stage operates in the common emitter configuration and develops its bias due to base-emitter conduction on positive half cycles. This stage is not keyed since it draws no current in the absence of r.f. drive. The 5 ohm resistance in the emitter circuit stabilizes the stage and prevents thermal current runaway. The amplified output appears across coil L_2 which is resonated by a 0.8-8.0 mmf piston-trimmer capacitor. Two additional capacitors of the same type form a capacitive voltage divider for driving the Varicap parametric frequency doubler. Second harmonic energy on 145.0 mc, which is generated due to the reactive action of the diode, appears across L_4 and is coupled to the whip antenna through a matching capacitor. The power output is between 100 and 200 milliwatts depending on the condition of the batteries. The battery life of OSCAR was calculated at approximately 30 days, plus or minus 10 days. The thermal life of the package is indefinite, but should remain in orbit for many months due to its small size and light weight. The transmitter was designed by Mr. Al Deim, W3LSZ/6.

The keyer, which is shown in fig. 2, starts with a clock generator. This is essentially a multivibrator consisting of Q_1 and Q_2 and the associated components. This stage generates very short duration pulses and provides the time base for the system. The clock is followed by five scale-of-two dividers which make progressively longer pulses (*i.e.* each divider doubles the length of the pulses). The output of the first divider, Q_3 and Q_4 provides the short pulses that form the dits in the call letters. By selecting the proper length pulses and mixing them in a diode matrix, it is possible to insert spaces at suitable points in the series of dits to form the letters HI, followed by a proper space between code groups. The clock circuit was intentionally made temperature sensitive (by using temperature sensitive base resistors) so that the keying rate would vary as a function of environmental heat. The original circuit was found to be so stable that thermistors were added to the clock generator to produce a known temperature sensitivity, that is, the number of HI's per minute. The modified equipment was then run through the temperature chamber and a calibration chart of keying rate versus temperature plotted.

Varying the keying rate also provides a means of coding OSCAR transmissions for confirmation of reception. In other words, reports will be confirmed with a suitable QSL card only if the HI rate and reception time given is correct. The keyer unit was designed by Mr. Harley Gabrielson, W6HEK.

Technical details of both units comprising the OSCAR package have been intentionally sketchy since the designers will surely want to generate technical papers of greater scope and engineering value.

Fly-By Tests

An additional test of the OSCAR package, a so-called "fly-by" was conducted to establish receiving strengths under similated orbital conditions.

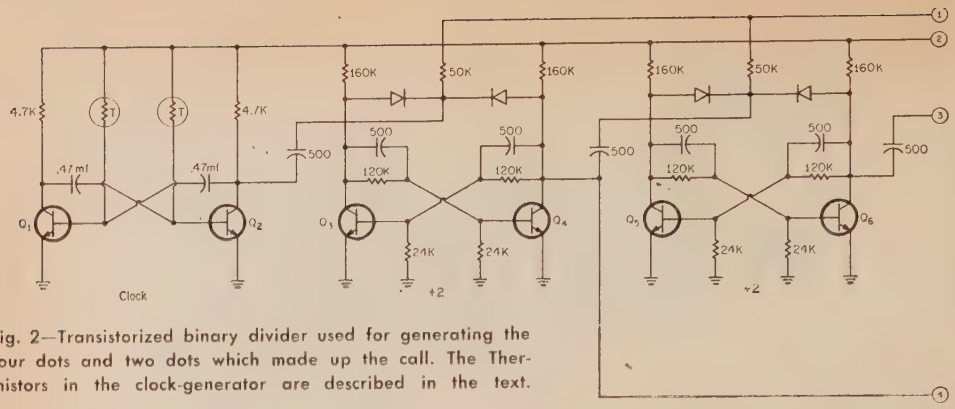


Fig. 2—Transistorized binary divider used for generating the four dots and two dots which made up the call. The Thermistors in the clock-generator are described in the text.

Participating clubs and many amateurs in Northern and Southern California had the opportunity to test their receiving and tracking installations through a series of these fly-by tests early in 1961.[1] It was also an excellent exercise for the data handling and processing people. In this operation, a prototype OSCAR package was flown over various areas to simulate an orbital passage. On April 9, 1961, an OSCAR package transmitting on 145.00 mc was installed aboard a Culver Cadet and flown for two hours in a triangular pattern from Palo Alto, California to Concord and Salinas, returning to Palo Alto. The success of these experiments, plus the enthusiasm of local amateurs who sent in reports, indicated a state-wide test was in order. Accordingly, on July 9, 1961, Charlie Metz, WA6LYZ and Hugh McClain, K6SPK, loaded the OSCAR package and two meter communications equipment into a Cessna 190 and flew from San José Airport to Long Beach Municipal airport and back. Many two meter stations were worked by WA6GFY/Aeronautical Mobile and these stations kept the operators posted on the reception of OSCAR transmissions. In addition, dozens of reports were mailed to the OSCAR headquarters and processed at the data handling center. Although a few "you-closed-the-eye-on-the-Communicator-at-1420-PDT" reports were received, the majority were properly executed in the prescribed manner and turned out to be quite useful to the data group. The strength and distance correlations indicated that just about anyone owning a Communicator and some sort of directional array, should have no trouble receiving OSCAR.

The Agena

The "bird" which carried OSCAR to its rendezvous with history was called the Agena and because of its part in the program, is worthy of special mention.

The Agena is a product of Lockheed Missile Systems Co.; prime contractor for the Discoverer series. The accompanying photograph of the "bird" being hoisted to a test cell shows the construction in detail. Agena measures 19 feet long, five feet in diameter and weighs about 1700 pounds when in orbit. It has its own integral liquid fuel engine which can be restarted permitting it to change orbits. It is the *only* satellite which is able to change attitude in orbit.

[1] Gmelin, J. A., "The Second OSCAR Flyover" *CQ*, Sept., 1961, p. 59.

At Vandenberg

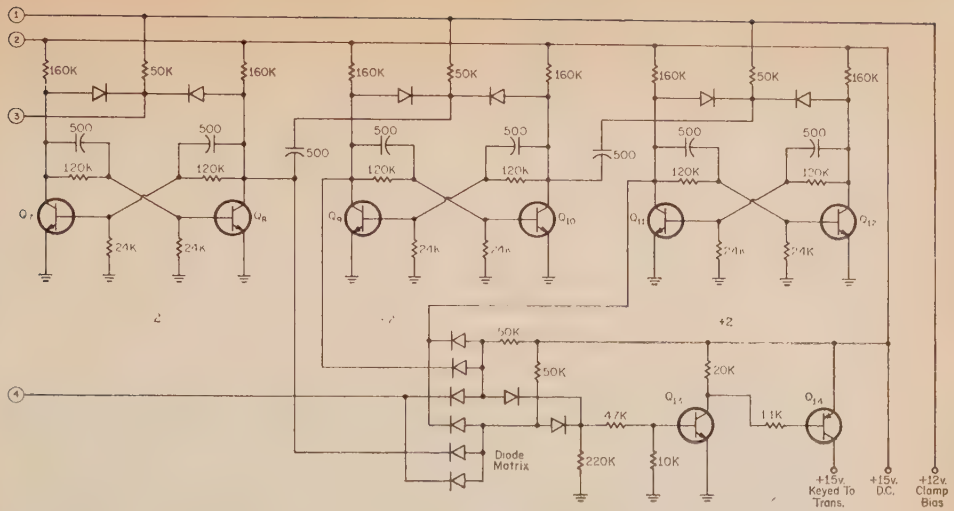
The big day, of course, was Dec. 12 and I reported in at Vandenberg in time to make the press briefing at 8:30 on that date. I was overwhelmed by the enormity of the installation.

Vandenberg occupies 68,000 acres of gently rolling countryside and is located about 80 miles north and west of Santa Barbara. It is a unique location for the projection of satellites into a north-south (or polar) orbit. The base is on a bit of land which sticks out into the Pacific so that there is a minimum of passage over inhabited areas. Examination of a map will show why this is so.

The OSCAR I package had been mated to the Discoverer and ready to "fly" since early in 1961. However, it was necessary for the OSCAR Association to meet certain requirements before Air Force permission could be granted. The resultant delays were finally cleared away in November and the green light was switched ON. The OSCAR package was assigned to a bird and a flight date established.

Early in December, the Agena was mated to the dependable workhorse of the Discoverer Project, the Thor booster. OSCAR was aboard this Agena and resided in the aft section alongside the propulsion motor. The Agena was modified by placing a squib-mount in the ribbing of the airframe (see Agena photo). The package, along with a myriad of other communications equipment, was covered by the skin of the bird.

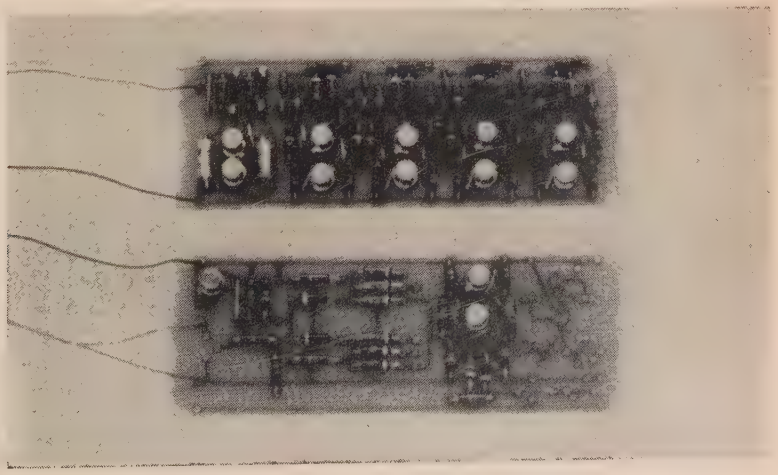
The shot day was beautiful, with only a slight overcast at about 25,000 feet. A very slight breeze was blowing off the ocean when we arrived aboard the press bus at the viewing site. Bill Orr, W6SAI, Chuck Towns, K6LFH and I arrived about 10:30 and eagerly awaited the launching. After several "holds", which delayed the launching from the 11:30 time, all was in readiness. It is interesting to note that



one of the "holds" was due to the Southern Pacific train which travels almost exactly through the center of the launching area! The train is followed each day by the Air Police helicopters until it is well beyond the base. At about 12:20 we noticed the lox (liquid oxygen) vapor blowing from the tank overflow and observed the ice crystals forming on the body of the Thor, which was located some 4,500 feet away. At last, with a brilliant burst of flame, ignition occurred at approximately 12:41 and the Thor slowly rose from the pad. With increasing speed the mighty engines lifted the Discoverer atop a brilliant orange tongue of flame. In almost the time it takes to describe the sight (and I must admit words fail me) the Thor punched a hole in the clouds and a tiny star of light diminished to nothing. The sight was certainly overwhelming and I recall thinking how could anything so beautiful ever be used as an instrument of war? The sound which emitted from the throats of the Thor engine was no less spectacular. The shock waves could almost be seen rolling across the hills and when it hit the press observation point there was a strange feeling in the pit of one's stomach—half emotional and half vibration.

Somewhere above the overcast the Thor arched over imperceptibly and headed downrange toward the floating tracking stations off the coast of Mexico and South America. Shortly after leaving smoggy Southern California the Thor expended its fuel and the empty carcass burnt up in a spark-producing plunge back through the atmosphere. After a short coasting period, the Agena engines ignited and propelled the payload to orbital velocity and altitude. Some 500 seconds after liftoff, when the Agena was near Pitcairn and Easter Islands, the Agena stabilized with the OSCAR package, approximately 20 degrees down from an axis parallel to the surface of the earth. During this attitude period a tiny contact on the Discoverer program flight timer sent a jolt of current to the explosive squib which had been restraining the compression spring on the OSCAR package and the package separated perpendicular to the bird at a velocity of approximately five feet per second and in a slightly downward direction. Separation from the vehicle also released a pin which permitted the spring-loaded battery ON-

[*Continued on page 108*]



Transistorized binary divider used for generating the HI call letters.

Blast Off! The Thor-Agena rising into orbit carrying the 10 lb. OSCAR payload. Those present at the field press-site at Vandenberg AFB were. W6SAI, K6LFH, W6MLZ, WØTSN and CQ's W6TNS. (Official U.S. Air Force Photo).

PROJECT OSCAR: A REPORT

Its History and Future

BY GEORGE JACOBS*, W3ASK

At 12:42 P.M. PST, on December 12, 1961, exactly 60 years to the day that Marconi first bridged the Atlantic Ocean with radio signals, amateur radio entered the space age.

At that moment, a tremendous Air Force Thor-Agena booster-DISCOVERER satellite was lifting slowly away from its launching pad at Vandenberg, California. With a mighty sheet of orange-yellow flame trailing from its tail, and with a thunderous roar, the 81-foot gleaming white giant missile curved gently into a partially overcast sky, and headed in a southerly direction toward a polar orbit.

Riding as ballast inside the rear section of the Agena satellite, the 36th in the Air Force's DISCOVERER series, was the small 10-pound OSCAR satellite and its self-contained 2 meter beacon transmitter, built entirely by radio amateurs.

At launch time, the following message was sent from the OSCAR Control Center at Sunnyvale, California by K6QEZ (operating on 21400, 14285 and 7220 kc):

"FM K6QEZ TO ALL STATIONS OSCAR NET. NR 00/122042Z. OSCAR LAUNCHED AT 2042Z. ESTIMATE ARRIVAL SOUTH POLE 25 MINUTES. ACKNOWLEDGE."

This was followed in three minutes by the following message:

"FM K6QEZ TO ALL STATIONS OSCAR NET. TRACKING LOOKS VERY GOOD AT 0 PLUS 3 MINUTES."

As the missile rose into space, telemetry data began to pour into the Vandenberg Control Center reporting all equipment as operating A-OK. At approximately 12:51 P.M. PST, about nine minutes after launch, a telemetric signal flashed showing that the Agena had ejected the OSCAR satellite at orbital altitude. OSCAR was now on its own, heading south towards the Pole, high in space.

The minutes began to tick away very slowly, with no reception from OSCAR on 145 megacycles. Five minutes passed, than 10, with no

*Propagation and Space Communications Editor, *CQ*.

Technical Sgt. James W. Oliver of Indianapolis, Indiana, gently installs the gold-plated aluminum OSCAR package into the ballast section of the Agena- DISCOVERER XXXVI satellite, which was launched successfully from Vandenberg, California on 12 December 1961. Once in orbit, OSCAR was ejected from its parent vehicle, its steel "whip" antenna erected, and its self-contained 100 mw transmitter began broadcasting a continuous series of HI's in Morse Code on 145 megacycles. (*Official U.S. Air Force Photo*).

reception. Had OSCAR's 100 mw transmitter failed? Then at 1:08 P.M. PST, the following electrifying message was relayed to OSCAR Control from KC4USB at Marie Byrd Base in the Antarctica by W4ABY:

"FM KC4USB TO ALL STATIONS OSCAR CONTROL NET. NR 026/122108Z. OSCAR SIGNAL RECEIVED AT 144.980 MC. SIGNAL FADED AT 2114Z. AZIMUTH 50 DEGREES. SIGNAL 2 DB OVER NOISE LEVEL.

Further acquisitions during OSCAR's initial orbit were also obtained by KL7EBM as the satellite passed over Kodiak, Alaska at 2:08 P.M. PST, and by KH6UK in Hawaii. OSCAR was successfully in a south-north polar orbit, and its beacon transmitter was GO on 145 megacycles, beeping out a continuous series of "HI's" in Morse Code. A two year dream was now a reality, amateur radio had entered the space age!

OSCAR'S Orbit

Tracking and reception data began flowing into the Project OSCAR Control Center at Sunnyvale, California shortly after launch. Radio amateurs throughout the world were receiving OSCAR's signal loud and clear as the satellite passed overhead. Amateurs tracked the OSCAR beacon satellite in almost 30 countries, and in such remote places as Antarctica, northern Alaska, Kuala Lumpur, Malaya and Capetown, South Africa. OSCAR'S transmitter was expected to remain on the air for approximately three weeks.

From the large mass of data flowing into OSCAR Control, precise orbital information was calculated soon after launch. The satellite was inclined 81 degrees to the equator, and its period (the time required to complete an orbit) was established as 91.7 minutes. This meant that on each successive orbit, OSCAR crossed the equator 23 degrees longitude further west. So precisely was OSCAR's orbit determined, that within a day or two after launch, the Control Center began issuing fly-over predictions for many areas of the world. This information was transmitted on W1AW and the VOA's SPACEWARN broadcasts.

The numerous reports of the number of HIs sent in a 10-second interval also made it possible to determine the temperature within the satellite with high precision. OSCAR's apogee (its highest point above the earth) was found to be approximately 300 miles; while its perigee (point of orbit nearest earth) was established at approximately 150 miles.

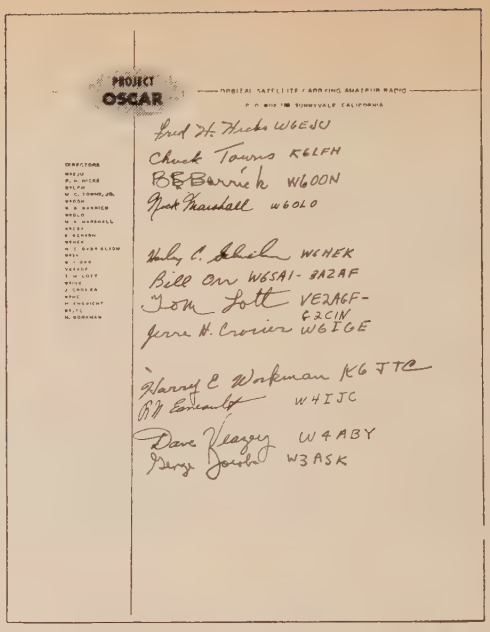
Tom Lott, VE3AGF/6, takes incoming OSCAR traffic at the Ampex Radio Club.

World Reaction

The successful OSCAR launching received very favorable reaction throughout the world. Congratulatory messages to the ARRL came in from radio amateurs, scientists and leading officials of this country, and from many foreign countries.

The OSCAR story was carried on all major TV and radio networks in this country, and by the major news services. The Voice of America carried the news abroad in several dozen languages, and the BBC had a special interview with one of the first English hams to copy OSCAR.

Receiving especially favorable attention were the facts that OSCAR was the first satellite to be launched at *no expense* to the U.S. Government (it was designed and built entirely by radio amateurs, and was launched in place of ballast), and that it was of a non-military, non-political, non-commercial nature in which the entire world had been invited to participate. The only compensation received by the radio amateurs participating in the project was the



Captain David J. Veazey, W4ABY, and CQ's Space Communications editor, W3ASK, signing the "OSCAR Father's List" (right) which was subsequently carried aboard the radio amateur satellite as it was orbited into space. Both W4ABY and W3ASK held down the "hot" Washington end of Project OSCAR, and were responsible for handling negotiations concerning the project at government level. The "list" contained the names of those amateurs who participated actively in the development of the project. W4ABY was also responsible for establishing contact with KC4USB, and receiving the initial confirmation that OSCAR was successfully in orbit.

satisfaction of having served science.

OSCAR'S successful launching received considerable praise within the U.S. Government. Although modest in scope, the project was a positive example of the United States' often-expressed desire that space activities be conducted in a peaceful atmosphere of open cooperation with all nations.

OSCAR'S Accomplishments

Through worldwide participation in the project, radio reception, tracking, and other data were gathered from thousands of points on the earth's surface. Such a large amount of data could not have been amassed as conveniently in any other way.

Much of the data is now undergoing intensive analysis by radio amateurs who are experts in the field of v.h.f. radio propagation, and other space sciences. Results of these analyses will be published for use by scientists throughout the world.

But perhaps most important of all, OSCAR has given amateur radio a much needed "shot in the arm." It has proven in a very dramatic way that radio amateurs, with proper organization, can still contribute much to the advancement of science.

Although entirely coincidental, it is indeed symbolic that the latest achievement in amateur radio communications should have occurred on the 60th Anniversary of Marconi's historic first transmission by radio across the Atlantic Ocean.

Future OSCARs

Plans are now being formulated by the Project OSCAR Association for the next step in the Project OSCAR program. Two back-up payloads, similar to the one now in orbit, and which were planned to be used in the event of failures, are available if there is tangible evidence that their launchings would produce additional useful data. If it is decided to launch one or both of these 2 meter beacon transmitters, it is expected that several months may be required for the government to assign a launch date and carrier.

Amateur radio is essentially a hobby of communications between individuals, and the ultimate goal of normal amateur activities is person-to-person communications. With this in mind, the Project OSCAR Association has already drawn up preliminary plans for an active radio satellite which would be capable of radio relay operation between two v.h.f. amateur bands. Such a communications satellite would receive signals on the 6 meter band, and simultaneously re-transmit them on 2 meters. The satellite would service a ground area of approximately 2,000 miles in diameter, making it possible for amateurs to relay v.h.f. signals across the continent.

SPACE will carry the latest information of future OSCAR plans as soon as they materialize. Meanwhile, radio amateurs everywhere are invited to submit their ideas for future OSCAR satellites directly to Project OSCAR, Box 183, Sunnyvale, California. It would be appreciated if copies of material sent to Project OSCAR would also be sent to the SPACE COMMUNICATIONS Editor, *CQ*.

The OSCAR Story

The complete story will probably never be told of the tremendous effort that went into

getting OSCAR I off the ground—the long hours spent in designing and fabricating the package, the frustrating red tape encountered when Government agencies were approached concerning a launch, the letter writing, the door knocking, the button holing of top-level Government officials to gain support for the project, the long anxious weeks waiting for a launch date, the exciting moments as the carrier slowly rose from its pad, climaxed by the thrilling confirmation that a successful orbit had been established, are all part of the OSCAR story.

In saluting radio amateurs everywhere on the success of OSCAR, this column would like to review briefly some of the interesting circumstances that made *CQ* an important part of the OSCAR effort.

In response to the first SPACE COMMUNICATIONS column which appeared in the September, 1960 issue of *CQ*, the following is part of a letter received from Fred Hicks, W6EJU, of Sunnyvale, California:

September 19, 1960

W3ASK DE W6EJU

Dear George:

"I am having difficulty thinking how best to phrase what I have to say. First, I am truly flabbergasted to note your new department in *CQ*! Next, I am dumbfounded at the perfect time in which it appeared . .

"Now sit tight and try to relax. Out here on the west coast there has been a lot of activity for over a year now to get someone to assist us in placing in Orbit a Satellite Carrying Amateur Radio (Project OSCAR) . . . the idea which first was published by Don Stoner as a space filler in *CQ* over a year ago finally has some body to it . . . I wrote Don asking for more details. He sent me a carefully prepared proposal wherein the name OSCAR first appeared . . . by talking the idea up over the air, I finally acquired a real going bunch who helped make up the OSCAR Committee . . .

"We (the Committee) have a three phase program in mind: 1. Simple beacons . . . with all the power we can pack into our space/weight allowance, so that the average ham can hear it with conventional equipment . . . 2. A space repeater (translator capability) series, to develop longer ranges on v.h.f. . . . Phase 3: This one we dream about. A television transmitter, stabilized by means already developed by one of our members, will transmit a picture back to earth. A simple converter with its output tuned to some unused channel on an ordinary television receiver will enable a ham to view the earth via his own satellite! . . .

"We have released no publicity as yet (concerning Project OSCAR) . . . We have space, tools, machinery, and parts enough to build anything, and a long list of specialists (all radio amateurs) who want to work on the project. It shouldn't be too long before we get some action. You may use any of this to prepare articles for your column . . ."

73,

FRED H. HICKS, W6EJU

Chairman Project OSCAR Committee

This letter fired the imagination of the *CQ* staff, especially since the project had been developed from a suggestion contained originally in this magazine.[1]

The following is part of the reply to Fred Hicks' letter:

[1] Stoner, D. L., SEMICONDUCTORS, *CQ*, April, 1959, p. 84

September 22, 1960

W6EJU DE W3ASK

Dear Fred:

"Your most interesting letter of September 19 requires an immediate reply. I had heard rumors about Project OSCAR before, but your letter gave me the first real information about it. I think that it is a GREAT idea. Count on me for whatever support I can give. Of course, I'll feature the story in my Space Communications column which will appear in December's *CQ* [1960] . . . If there is any way that I can help the project, please let me know."

73,

GEORGE JACOBS, W3ASK

Space Communications Editor, CQ

During the interval between the time the above letter was sent, and the time that the OSCAR story first appeared in print, the project moved forward. Discussions had begun with various government officials to see if the OSCAR satellite could be launched piggy-back with a government satellite. Although most officials approached indicated a sincere interest in the project, it soon became apparent that unless there was solid support behind the project, on both the national and international level, the government could never consider the unprecedented action of launching such a satellite.

ARRL Sponsors OSCAR

It was at this point that action was begun to place the OSCAR project under the sponsorship of the American Radio Relay League. The following letter was sent by Bill Orr, W6SAI to John Huntoon, the then Assistant General Manager of ARRL, and now the League's General Manager:

Dear John:

"John, I want to discuss this amateur space satellite program with you. I think that a dazzling opportunity lies ahead for amateur radio to grasp; but like the nettle, if not grasped properly, the amateur might be hurt.

"I personally feel that the years ahead will be years of trial for amateur radio, and only by a forceful, vigorous emphasis upon our contributions to 'public interest, convenience and necessity' will we survive . . . It is now up to us to perform 'advance state of the art' experiments and tests to continually emphasize and reemphasize that there is more to amateur radio than the daily meeting of the Chairwarmer's phone net on 80 meters. We must present an intelligent, alert, and active face to the country and to our government, so that when the chips are down, the value of the amateur to his country cannot be brushed aside. Only by our value to our country will we be judged, and only by our accomplishments will we be measured. It is up to us to see that we have maximum stature when this solemn and critical time arrives.

"As I have told you, a proposal has been made to place an amateur satellite in orbit, using a future space vehicle as a "piggy-back" carrier. Originally proposed by Don Stoner (W6TNS) of *CQ*, this jocular idea . . . upon close examination was found to have considerable merit . . . Tentative plans have been formulated (by the Project OSCAR Committee) for such an amateur satellite, and considerable interest has been aroused in the idea . . .

"A need exists for strong, amateur leadership from a group that represents a majority of the amateurs, rather than a small, local club. I believe that the only organization that can truly represent the amateur

The Directors of the Project OSCAR Association meet in Sunnyvale, California to discuss final arrangements prior to the satellite's launching. Working during their spare time, this group of radio amateurs built and tested the home-made radio amateur satellite. Hundreds of other amateurs throughout the world participated in the organization of a world-wide tracking network, and in data collection and evaluation. Directors are: (left to right) Fred Hicks, W6EJU; William I. Orr, W6SAI; Harley Gabrielson, W6HEK; Thomas Lott, VE2AGF/6; Chairman M. C. Towns, Jr., K6LFH; B. Barrick, W6OON; Dick Esneault, W4IJC/6; Harry Workman, K6JTC; and Nicholas Marshall, W6OLO.

in this matter is ARRL. Without the ARRL sponsorship, the amateur satellite program will wither and die.

"Moreover, I believe it is in the best interest of the ARRL to be an active leader in such a program; only by such leadership will the ARRL be able to control a program of this type which will ultimately involve a large percentage of the amateurs in the United States. By sponsoring this program, the prestige of the ARRL will be advanced, amateur radio will gain stature in the eyes of the world, and the amateurs will have made a lasting contribution to our country!"

73,
WILLIAM I. ORR, W6SAI

The following letter, on the same subject, was sent to the League by W3ASK:

November 15, 1960

Dear John:

"I am enclosing a pre-print of my SPACE COMMUNICATIONS column for December, 1960. Most of the column is devoted to "Project OSCAR," a planned satellite program for radio amateur participation. I think that the idea is a good one, at least in principle, although I'm afraid it doesn't stand a chance of adoption by our space people, and indeed may even be counter-productive, unless it has REAL support behind it.

"Call it Project OSCAR, or anything else, but I think that the time is ripe for some sort of radio amateur participation in our country's space program. There are space programs now in the planning stage to which amateur radio could contribute an enormous amount of information, along the lines of the old RASO project, or the very productive ARRL IGY Project. If the response that I have received to my SPACE COMMUNICATIONS column in *CQ* means anything, amateur radio is 'champing at the bit' to do its part in this exciting new field of communications. But unless solid support is thrown behind it, the chances are that the space people will overlook the tremendous potential amateur radio offers as a trained data collecting source.

"I keep stressing the word REAL, because I think that small groups like the Project OSCAR Committee, with all the talent, sincerity and devotion that they have, just aren't big enough to be taken seriously by our space people who must plan useful and practical space programs. The REAL support can come from only one direction, ARRL . . .

"How about it? A space program in which ARRL coordinates amateur participation. In the bitter fight for the radio spectrum that lies ahead in the next decade, I think that our hobby, if it is to justify its future survival, must participate in useful scientific projects, and space communications is a natural.

"The job, however, isn't for a small devoted group of radio amateurs in California, or in Washington, D.C., nor is it a job for *CQ*. There is only one organization that represents our hobby, and that's ARRL. There's a real challenge here, the kind Hiram Percy Maxim would have tackled with one hand tied behind his back. Let's have some of that old time pioneering spirit again, it could well mean the future of our hobby.

73,
GEORGE JACOBS, W3ASK

OSCAR Moves Ahead

During early December, 1960, the League replied to both W6SAI and W3ASK stating that "ARRL's participation and cooperation will undoubtedly be forthcoming when the details can be worked out."

The League officially approved sponsorship of Project OSCAR during March, 1961, and it was announced in the May, 1961 issue of *QST*.

The following letter was sent to ARRL upon learning that the League intended to sponsor Project OSCAR:

Dear John:

". . . Congratulations, I am very glad to learn that ARRL will take up the challenge and will lead amateur radio into the space age. As I mentioned in my letter to you of November 15, this is exactly as it should be.

"While personally I might think this action a bit overdue (especially when I think back to the Geneva Conference, and how close we came to losing so much of the amateur h.f. bands . . .), the main thing is that the challenge will now be met with capable and competent leadership. This action by the League has my wholehearted support, and you can count on me to help out in any way that I might be able . . . I think that we should close ranks now and work hand in hand towards creating a stronger foundation upon which we can argue for the future existence of our hobby, if it ever becomes necessary to do so. You can count on my support."

73,
GEORGE JACOBS, W3ASK

December, 1961's SPACE COMMUNICATIONS column broke the OSCAR story to the world. Judging by the response, Project OSCAR fired the interest of radio amateurs throughout the world. The original story was translated into several different languages, and appeared in radio amateur journals in many foreign countries.

Fred Hicks, the Project OSCAR Committee

Chairman, reported enthusiastically that more and more radio amateurs were joining the project. By early 1961, the design of both the satellite casing and the beacon transmitter had been completed, and fabrication of both had begun. Plans were also begun to organize a world-wide radio amateur tracking network, and a comprehensive data collection and analysis program. The Project OSCAR Committee changed its structure to that of a formal Association, in order that radio amateurs throughout the country, and overseas, might join the program. The dynamic M.C. "Chuck" Towns, Jr. (K6LFH) was elected Chairman of the Association's Board of Directors.

Under ARRL's banner, and the energetic leadership of K6LFH, the Project OSCAR program moved along at a very rapid pace during early 1961. By April, the entire payload, including the beacon transmitter and its automatic keyer were completely fabricated and assembled. The letters HI were selected as OSCAR's callsign, because of the friendly and jovial meaning of the expression, and because of the relatively low battery drain required to transmit this combination of letters.

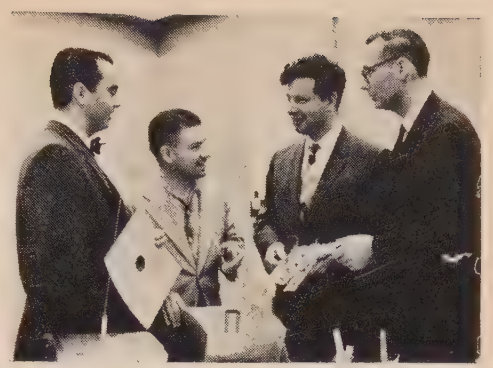
During late April, the FCC granted a special authorization to flight test the OSCAR package from an airplane, and OSCAR's 100 mw transmitter was heard over a relatively wide area of southern California. Also encouraging, was the great amount of interest the project had created in amateur radio and other scientific circles, both in this country and abroad.

Government Negotiations Begin

With much tangible evidence now available both as to the support and objectives of the project, serious discussions were begun in Washington during April with high Government officials concerning OSCAR's launching. The Air Force indicated that it would be willing to launch OSCAR piggy-back with some future DISCOVERER satellite, if other Government agencies concerned also approved the project. The OSCAR piggy-back launching would be accomplished at no cost to the American taxpayer, since the package would replace ballast usually carried on the booster rocket.

In June, Project OSCAR's famous *White Paper* was issued by the Project OSCAR Association (it appeared in August's SPACE COMMUNICATIONS column). This paper formed the basis of discussions with the Department of State, which was responsible for coordinating views of the FCC, NASA, and other Government agencies interested in the OSCAR program.

On July 31, 1961, after several weeks of preliminary discussions, a formal letter was sent from ARRL to the Department of State requesting Government approval of the project. The State Department's reply of September 15, stated that, "after consultation with other interested agencies of the Government, the Department of State perceives no objection to the carrying out of Project OSCAR."



Al Diem, W3LSZ/6 (holding the ring) discusses technical aspects of the OSCAR package with Harley Gabrielson, W6HEK, (holding the keyer board which he designed) and Bernie Barrick, W6OON.

The State Department's letter was then forwarded to the Department of the Air Force, which had agreed to place the OSCAR payload in orbit. In the meantime, the FCC issued a station license to the OSCAR transmitter, with the call W6EE, and suspended other rules and regulations pertaining to the amateur service as far as OSCAR was concerned.

Dream Becomes Reality

A hoped-for late September launching date passed without any word from the Air Force. Anxious moments during October were followed by even more anxious moments during November, but no launch. Then, late during November, the Air Force announced officially that OSCAR would be launched with a DISCOVERER satellite sometime during December, and the rest is history!

In this brief review of OSCAR's transformation from a dream to reality, the valuable contributions of many individuals have escaped mention. As amateur radio enters the space age, *CQ* salutes the Project OSCAR Association, the American Radio Relay League, and all those unsung individuals who helped make the project one of the greatest successes in the long history of amateur radio communications.

Perhaps the statement made during a BBC interview by Angus McKenzie, the first British ham to copy OSCAR's signals, best sums up the situation. When asked how he felt at hearing signals from a radio amateur transmitter orbiting in space, Angus replied, with typical British reserve," It was very exciting, I shall never forget it." ■

Satellite Transmission Information

According to monitoring reports received from readers of this column, and from public information released by the National Aeronautics and Space Administration, transmitters on the following satellites were still in operation at the end of 1961.

[*Continued on page 106*]

How Kit Transmitters Work

PART I

BY DAVID T. GEISER*, WA2ANU

Many Novices (and quite a few Generals too) get on the air with kit type transmitters because of the economy and ease of this approach. The kit builder frequently does not have the technical "know how" to adjust the transmitter properly, much less service it. This two part series is designed to improve the Novice's understanding of his transmitter (and the General's too) so that he may operate most effectively.

THE kit transmitter occupies a definite place in the life of present-day American amateurs. This type of transmitter has helped many persons get on the air who otherwise would not think they had the time, money, or skill to set up a station.

The kit-builder often does not have the background to enable him to get the most out of his transmitter. Adjustment of even the simple rig can be confusing, and the Editor of *CQ* asked the author to try to list the theory, adjustment procedure, and precautions of simple transmitters in ways that would be helpful to kit builders and users.

To this goal, the radio frequency (r.f.) portions of many common transmitter kits suitable for the Novice will be discussed. Not all kits can be covered, but at least part of this two-part article will apply to the theory behind every transmitter. The first part of the article will cover generation of the desired frequency, up to the plate of the final amplifier; the second part covers amplifier plate conditions and antenna loading. Transmitters specifically discussed[1] are the Eico Models 720 (A) and 723 (B), Globe Chief Models 90A (D) and Deluxe (E), Globe Scout 680A (F), Heathkit Models DX-20 (G) and DX-40 (H), Knight-Kit Model T-50 (J), and Johnson Viking Adventurer (K), Challenger (M), Navigator (N), and Ranger (P). This is by no means a complete list of useful transmitters, but is representative.

The Crystal

The simplest frequency control for a transmitter is a quartz crystal[2]. Quartz, carefully cut and used in a properly designed circuit, will mechanically vibrate like a violin string or a tuning fork. During such vibration electrical changes of current will take place in the circuit at the rate of crystal vibration. These electrical changes, or alternations, are actually a radio signal with very low power. They may be amplified to make a stronger signal, and this is the purpose of the transmitter. The rate of the vibration (cycles per second) is called the frequency of the crystal.

Crystals that vibrate several million cycles (mc) per second are thin and fragile. If too much power is put into them by a circuit, they will heat and possibly fracture. When they heat, they swell. This causes them to vibrate at a different frequency and the transmitter frequency drifts. This can happen during a single dot or dash in a poorly adjusted circuit, so it is well to ask other amateurs if your signal "chirps." Operation with a chirping crystal will, at the least, break the crystal and may earn you a violation notice from the F.C.C.

Crystal Oscillator Circuits

The most common oscillator circuits used in kits are the grid-plate (A, B, D, E, F, G, H,

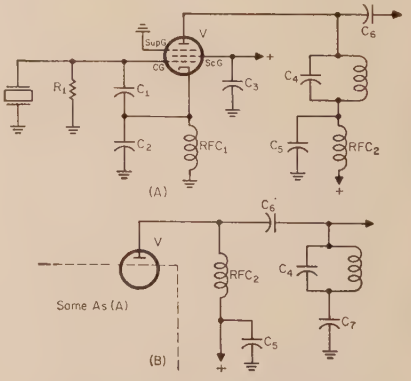


Fig. 1—Two crystal oscillator circuits commonly found in kit type transmitters. Component values for the different kits are listed in Table I. Circuit (B) differs from (A) only in the plate wiring and both are considered to be grid-plate circuits.

*Light Military Electronics Department, General Electric Co., Utica, New York

1 Letters in parentheses after each model number will be similarly used in discussion to show models to which a particular comment applies.

2 Schure, *Crystal Oscillators*, John F. Rider *The Amateur Radio Handbook*, ARRL, 38 ed. p 51, 145

Kit	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	R_1	RFC_1	RFC_2	V	Fig.
A	22	220	10K	Cpk	10K	125	—	—	100	1	—	6CL6	1a
B	22	220	2K	50	10K	1K	220	—	100	1	1	6CL6	1b
D	33	500	5K	75	5K	33	—	—	47	.75	—	6AG7	1a
E	33	200	5K	75	5K	33	—	—	47	.75	—	6AG7	1a
F	15	120	5K	75	5K	33	—	—	47	2.5	—	6V6	1a
G	22	220	5K	50	5K	22	—	—	100	1.1	—	6CL6	1a
H	22	220	2K	Cpk	2K	47	—	—	100	1.1	—	6CL6	1a
J	Cgk	—	10	75	5K	100	—	1K	47	—	—	6AG7	2
K	same as J, only minor changes between designs												
M	Cgk	68	5K	100	1K	50	—	—	100	2.4	2.4	6DS5	1a
N	25	200	5K	50	1K	50	—	—	100	2.5	2.5	6CL6	1a
P	25	200	5K	Cpk	5K	50	—	—	100	2.5	—	6CL6	1a

Table I—Component values for oscillator circuits used in various kit transmitters.

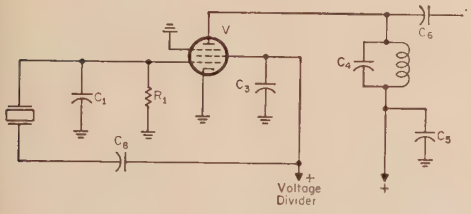


Fig. 2—The modified Pierce crystal oscillator circuit. Component values are listed in Table I.

M, N, P) and modified-Pierce (J, K) circuits[3]. These circuits are shown in figs. 1 and 2, with values for individual trans. shown in Table I.

An oscillator is nothing more or less than an amplifier with some of the energy in its output circuit fed back into the input in time to reinforce itself. When this signal reinforcement builds up to some maximum voltage or current, the circuit will limit further buildup. Should an element with inertia (such as a quartz crystal) be in the feedback path of the "amplifier" (that we are using as an oscillator), this element will now try to swing the output down in voltage or current. The amplifier senses this downward trend and increases the downward swing. On reaching "bottom", the inertia element will start a second upswing. Thus, both amplification and an element such as a crystal are necessary in an r.f. oscillator. Any element that exhibits this "flywheel" action of a crystal may be used, but a crystal is the best and least expensive way to generate a very stable freq.

Figure 3 shows the circuitry basic to both of these oscillators. The crystal is connected between the grid and the plate, with the grid-to-cathode and cathode-to-plate capacitance controlling the amount of energy fed back from the plate to the grid. Note that no way is shown for energy to be taken out of this circuit to feed the antenna.

[3] Chambers, Crystal Controlled Oscillators, *QST*, March 1950 p. 28.
Terman, *Electronic and Radio Engineering* McGraw-Hill, 1950 p. 515-519

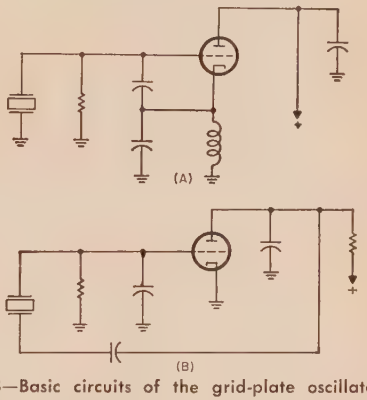


Fig. 3—Basic circuits of the grid-plate oscillator (A) and Pierce oscillator (B) with the screen grids shown acting as the plates.

When we look again at figs. 1 and 2, we see that the screen grid (sg), cathode, and control grid (cg) appear to be performing the actions of the plate, cathode, and control grid of fig. 3. This is what actually happens. Tubes do have an amplifying characteristic between the control and screen grids. Few tubes so connected have an ampilfication factor greater than 8; the 6CL6 (A, B, G, H, N, P) and 6AG7 (D, E, J. K) are exceptions with a screen grid gain of 20 or more. These two tubes are quite popular as oscillators because their use permits crystal oscillation with little heat or danger of crystal fracture.

Use of a screen grid oscillator circuit has another advantage; the stream of electrons from the cathode largely passes through the screen grid pulsing at the same rate as the oscillation. The plate, where most of these electrons go, thus receives much radio energy having no direct connection to the oscillator. This circuit is called an electron coupled oscillator. If we wish, we can feed this plate energy to an antenna or an amplifier without much adverse effect on the amount or stability of oscillation.

The pulses of energy have components of the crystal frequency and harmonics.[4] A harmonic is the crystal frequency multiplied by a whole number. Sometimes a harmonic is desired; often it is not. The shorter a pulse is, the more harmonic energy is in it. Most kit oscillators generate both fundamental and harmonic energy. Tuning is used to *select* the basic frequency or desired harmonic. (The second harmonic is 2 times the crystal frequency, third harmonic 3 times, and so on.)

Tuning

Quartz (or any other mechanical vibrator) oscillates because it has both inertia and elasticity. If it is stressed out of shape, elasticity will make it spring back to its original shape and inertia will carry it past its original shape. Likewise, it will again pass its de-energized shape on its next attempt to return to size. In a violin string, the oscillation is maintained by continuing to put energy into the string with a violin bow. The oscillator circuit does the same thing to a quartz crystal.

Coils display electrical inertia, and capacitors show electrical elasticity.[5] Thus we naturally expect a coil connected to a capacitor to exhibit vibratory effects, and the circuit made up of these two parts does. If the two terminals of a coil are connected to the two terminals of a capacitor (fig. 4) and a pulse of electrical

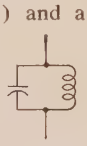


Fig. 4—A tuned circuit consists of an inductor and capacitor which may be placed in parallel as shown above. The circuit, commonly used for selecting desired frequencies, is also useful for impedance matching as shown in fig. 7.

energy is impressed, a gradually-decaying electrical vibration will result. If a train of pulses is impressed across the circuit and has a frequency component (fundamental *or* harmonic) that is exactly the same as the electrical vibrating frequency of the coil-capacitor *(LC)* combination, this common frequency will be built up and maintained in strength in this circuit. All other energy at different frequencies will be reduced. If enough tuned cirucits[6] are used, unwanted frequency energy practically disappears.[7] Thus, most oscillators use a parallel-tuned circuit (as described above) in the plate to select the desired fundamental or harmonic. Rough tuning is accomplished by switching coils and/or capacitors;[8] fine tuning is done by varying the capacitors or inductance in some easily and smoothly adjustable fashion. Variable capacitors are slightly more common, and change value by varying the opposing areas of two electrical conductors that are insulated from each other. Variable inductors (coils) have adjustable slugs that vary magnetic fields (and hence inductance[9]) or move a tap along a coil to energize different numbers of turns.

Frequency Multipliers

Occasionally amplifiers are specially designed to create harmonics.[10] Oscillator output is used to drive the amplifier strongly so that its plate current will flow in short pulses. Assuming a smoothly varying output (that is, a single frequency) from the oscillator, the amplifier must be adjusted to distort this wave to make short pulses. This is done by impressing a large oscillator signal and adjusting the amplifier grid voltage so that the harmonic-generating amplifier can conduct plate current only on the peak of the oscillator wave. Usually, this is done by having a grid leak (grid-to-ground) resistor in the amplifier grid circuit and storing the voltage developed by the flow of amplifier grid current in the capacitor that couples the oscillator to the frequency multiplier.[11] (This is automatic.) The oscillator plate is tuned for maximum amplifier grid current and all conditions are met for harmonic generation. The frequency multiplier plate circuit is tuned for the desired harmonic, and output at that frequency is obtained. In this tuning it is very necessary to pick the *desired* harmonic for many harmonics do not fall in amateur bands.

Many transmitters have provisions for adjusting amplifier drive for best results. In the simplest and least expensive transmitters, this consists of detuning the oscillator until the amplifier current is some specified value. (As previously noted, oscillators driving harmonic generators are usually tuned for maximum output, but when used to drive a final amplifier are frequently adjusted for some specified grid current rather than maximum.) Detuning is undesirable as this degrades the single-frequency-purity of the output, but is acceptable if it does not introduce chirps and other measures are taken to eliminate output on unwanted frequencies.[12]

A more elegant way to adjust drive is to vary the screen voltage of the oscillator (N) or the driving amplifier (A, P). The output depends to a large extent on screen voltage, and use of a potentiometer (fig. 5) connected in voltage divider arrangement (A, P) permits easy adjustment to suit the possibly differing output of different crystals and bands. One transmitter (N) even adjusts drive by switching the voltage divider at the same time bands are changed.

[4] ARRL, op. cit., p. 67
Terman, op. cit., p. 473-477
[5] ARRL, op. cit., p. 23, 26, 33, 43
Terman, op. cit. p. 24, 30
[6] ARRL, op. cit., p. 43
Terman, op. cit., p. 50-57
[7] ARRL, op. cit., p. 46
Terman, op. cit., p 404
[8] ARRL, op. cit., p. 92
Terman, op. cit., p. 947
[9] ARRL, op. cit., p. 93
Terman, op. cit., p. 33-35
[10] ARRL, op. cit., p 165
Terman op. cit., p 473-477
[11] ARRL, op. cit., p. 154
Terman, op. cit., p. 457-458
[12] Tuned circuits in the following stages.

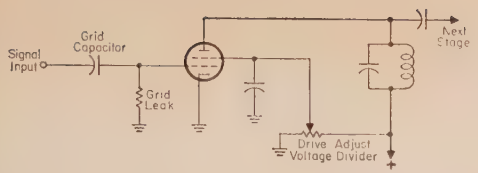


Fig. 5—An amplifier or frequency multiplier using a voltage divider to adjust drive to the next stage.

Amplifying

The purpose of an amplifier is to increase the power of a signal, and the characteristic of a signal is a most important consideration. For the sake of this discussion, it will be assumed that the signal is a radio code signal, with periods of transmission in the form of dots and dashes (interrupted continuous wave or c.w.) in an otherwise no-signal period. The amplifier must be able to amplify the radio signal and yet not be damaged by periods of no-signal.

Earlier in this article, the use of a grid leak to supply grid bias was mentioned. Grid bias is a good way to protect an amplifier from drawing too much current (N), but if the presence of bias depends on a driving signal it cannot offer protection during the no-signal time. To offer protection, many transmitters (A, B, D, E, F, G, H, J, K) key the final amplifier at the same time as the oscillator. When a tube does not have grid bias, but has all other connections and voltage present, it may draw heavy, possibly destructive, current. This danger encourages use of "clamp tube" protection (A, M, P) (fig. 6).

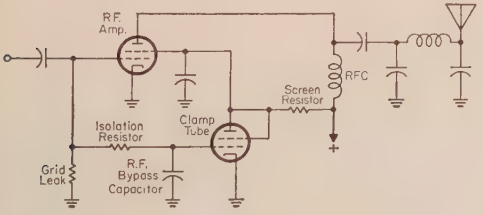


Fig. 6—Shown above is a clamp tube circuit used to reduce amplifier screen voltage and therefore plate input when the r.f. amplifier is not being driven.

The current of an amplifier depends greatly on the amount of screen voltage. The clamp-tube method drops the screen voltage of a final amplifier when there is insufficient signal present at the amplifier to develop safe grid bias.[13]

When using this method, screen voltage for the amplifier is obtained through a screen resistor. The clamp tube plate is connected to the amplifier screen, and the clamp tube grid samples the grid bias developed by the power amplifier grid from the incoming signal. When insufficient bias is developed, the clamp tube draws heavy current through the screen resistor, dropping the screen-grid source voltage almost entirely across the screen dropping resistor and leaving none to power the screen of the final amplifier; the final amplifier tube is protected from excessive plate current. When the final amplifier grid has sufficient drive to develop grid bias (and it is time to start amplification), the clamp tube will also be biased and will no longer conduct. (The radio signal does not reach the clamp tube because of the *RC* filter.) Clamp tube drain no longer flows through the screen dropping resistor, and the power amplifier screen voltage rises to its normal value. Amplification is normal during a dot or dash.

Of course, a fixed bias voltage (N) could have been applied to the final amplifier grid from either a battery or negative power supply. In some cases keying is used to supply this bias (D, E, N, P), and this form of keying is known as "grid-block" keying.[14] This is a particularly useful form of keying, for the manner that the bias is applied can be arranged to prevent key clicks as well as to provide keying and protection.

Drive Power[15]

Moving over to the final amplifier grid: The grid of the kit transmitters (like most common ham rigs) requires considerable drive power for most efficient operation. The word "considerable" is purely relative, as in the listed kits, half a watt or so is adequate. Comparison with tube charts shows that these tube grids do not require that much power, and it is true that the tubes themselves do not. We are dealing with radio frequencies here, and as the British term "wireless" implies some of the energy does not stay in the wires to drive the tube. Some escapes from the wiring, some is burned-up to provide grid bias, and some is turned to heat while passing through the coils and wiring. This last effect, present in every radio circuit, is the reason that coils are often silver-plated. Silver is a much better electrical conductor than copper or tin, and radio frequency currents flow on the outer surface of the wire. This is called skin effect.[16] You may note that quite frequently more drive is required for an amplifier on 28 mc than 3.5 mc, or that there is less output for a given amount of drive. These factors explain much of the cause.

The Tank Circuit

So far, this discussion has created a signal, selected the desired frequency, and placed the signal in the final amplifier tube. Though the discussion is nearly half over, the operation of the remainder of the circuit can greatly affect the quantity and quality of the output.

Some of the transmitters use the final amplifier as a doubler (B, D, E, F, G, J, K) on the upper one or two bands.[10] The efficiency of

[13] ARRL, op. cit., p. 154-156
Smith, "A Substitute For Safety Bias When Using Screen-grid Tubes," *Radio*, Dec. 1941, p. 13

[14] ARRL, op. cit., p. 244, 246
Crawfis, "Simplified Break-in with One Antenna," *QST*, Nov. 1954 p. 30 (N, P)

[15] ARRL, op. cit., p. 156-159
Terman, op. cit., p. 448-471

[16] ARRL, op. cit., p. 19
Terman, op. cit., p. 21-24

an amplifier tube is only 35% or so in such service, compared to a theoretical maximum of over 95% as a class C amplifier. (High, but impractical; 60% is more common.) Thus while enough power is available for pleasant contacts on the higher bands, the owner of a doubling final amplifier should not expect as much output as on lower frequencies.

There is another factor related to efficiency; tank circuit impedance.[17] The characteristic of impedance of a tuned circuit ("tank circuit", so called because it stores energy) is not heat-producing resistance necessarily (though some does exist), but is rather the reflection of the antenna impedance through the tuned circuit to the plate of the final amplifier tube. Tuned circuits with a load connected to them have the ability to step impedance (stated in ohms) up or down. Three such circuits are shown in fig. 7: the "L" network, the link-coupled, and the Pi (all kits). All of them can be reduced to L networks. The L network nearest the plate usually is the one that determines efficiency, and in each case C_1 should be approximately the same value for a particular tube voltage, current, and frequency. The impedance of the tuned circuit depends on the number of microfarads per meter wavelength. If, for example, the best compromise number is 2 micromicrofarads (mmf) per meter for a particular tube, 20 mmf

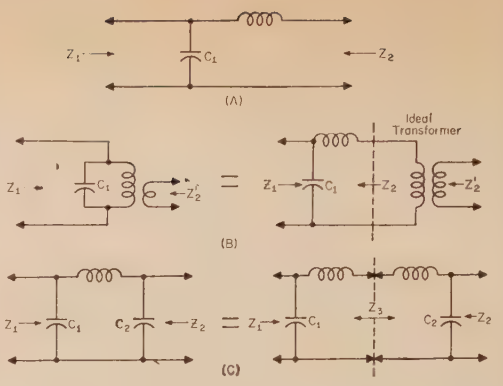


Fig. 7—L (a), Parallel-tuned (b), and Pi networks used for impedance matching. (See text.)

should be the value of C_1 on 10 meters (30 mc) and 160 mmf on 80 meters. It is hard to obtain such a range of capacity inexpensively, so the higher frequency range usually suffers in inexpensive transmitters. Higher than optimum capacitance is used and efficiency goes down.

Some advantage is gained by this practice, however, as the amount of harmonic radiation is usually reduced with a higher design capacitance, if the tank impedance is held constant. The tuned circuit becomes more selective.

Here we take a breather until the next issue, when we take cover details of the output circuitry, how to load the final into the antenna or transmission line, neutralization of the final, preventing parasitics, and the use of metering.

To be continued.

[17] ARRL, op. cit., p. 43-49, 149-153
Pappenfus and Klippel *CQ* Sept. 1950 "Pi Network Tank Circuits," p. 26.
Pappenfus and Klippel, "Further Notes on Pi and L Networks," *CQ* May 1951, p 50.
Grammar, "Simplified Design of Impedance Matching Networks," *QST*, March, April, and May 1957

Emergency Phone Patch

AMATEUR Radio, and the public service it performs, was brought to the public eye once again when Virginia McCubbin, KØYMC, Duluth, Minnesota, handled an emergency Phone Patch between Quito, Ecuador, and the Mayo Clinic in Rochester, Minnesota.

Virginia was in the middle of an enjoyable QSO with hams in Florida, when a ham in Quito broke in, requesting that she arrange an emergency Patch to the Mayo Clinic. A Quito nurse was being treated for rabbies resulting from a monkey bite and the doctors in that area wanted to confer with doctors at the Mayo Clinic.

Even though Virginia's QTH is Duluth, Minnesota, some 275 to 300 miles north of Rochester, she was not the least bit hesitant in placing a long distance call to the Mayo Clinic, contacting a doctor there, and setting up the Phone Patch for the medical conference.

While the outcome of this case is not known at this time, it must be assumed that Virginia's complete cooperation in this matter undoubtedly assisted in helping to preserve a human life.

Virginia deserves the congratulations of the entire amateur fraternity, for up-holding the public spirited nature of hams everywhere, as cases such as Virginia's are in evidence when ever the need arises.

As a token of appreciation for the public service spirit shown by Virginia, the E. F. Johnson Company was very happy to present her with a Viking Phone Patch to make her future patching easier and more enjoyable. ■

Caribbean Caper - PJ5MA

BY J. ARCHIBALD JR.*, K2AAC/PJ5MA

K2AAC gives us a warm account of a relatively unsuccessful DXpedition. His trials and tribulations (and they were plentiful) did not spoil his good time.

MY encounter with a salt-encrusted SX-101, relic of Yasme II, during a visit to KV4AA's shack in February 1960, was merely another link in a chain of events which for practical purposes started with a DJ3 QSO on the 21 mc novice band a few years ago, and has culminated in the prefix above, and the story below.

I can't tell you exactly when the idea of going on a DXpedition definitely took form, or when the decision was made to try for Sint Maarten, since the whole affair has its origin in something hinted at in the foregoing, and popular known as being bitten by the DX bug.

But I can tell you why I chose Sint Maarten[1]:

1 — It's accessible; only a few hours by air from New York City.

2 — It presented the potential of two DX prefixes on one small bit of real estate, with no customs formalities, since the island is a free port, and half under Dutch, half under French rule.

3 — Its climate and recreational facilities[2] offered good bait to get Jean, the XYL, to agree to the budgetary madness which naturally derives from such a venture.

Anyway, in early November, we set a date—the last two weeks in February—and I set about, a) wrangling vacation time, b) accumulating gear and c) obtaining licenses—while Jean researched the travel and hotel possibilities via the local travel bureau.

Choosing Equipment

By the middle of January, with a month to go, the pieces had pretty well fallen into place. The boss had agreed to try and struggle along without us for a couple of weeks. After a false start or two the travel bureau had confirmed reservations Buffalo-N.Y.-San Juan-Sint Maarten and return plus reservations at the Sea View Hotel, Philipsburg, Sint Maarten. A trusting soul had agreed to let us borrow his newly completed Heath Mohican transistorized receiver, and my search for a suitable rig came to a most happy end with the arrival of an Eico model 723.

Choice of equipment was dictated by two poignant factors: 1) Cost—Please note that I would be the last one on earth to try to talk the XYL into both the trip and a KWM-2 in one fell swoop and 2) Weight. A tourist class overseas ticket entitles you to 44 pounds of baggage, which meant an 88 pound allowance for clothes and gear. Something over two dollars a pound round trip for every pound over this provided sufficient incentive to undertake a weight elimination program; so by talking the wife out of a passel of clothes, loading sundry weighty bits of equipment i.e. bug, changeover relay, r.f. powered monitors[3], tools, antenna etc. into (so help me) her handbag, and by judicious use of the bathroom scale, we wound up with two pieces of luggage, plus transmitter and receiver, all of which weighed in at just under the magical number. Handbags, thank goodness, don't count!

To dwell for a moment in the equipment aspect—transmitter and receiver weighed in at 15 lbs. apiece. The Heath transistorized receiver, and its capabilities have been pretty well publicized, but the Eico 723 is sufficiently new to warrant a brief description. It's a simple reliable 60 watt xtal controlled two stage cathode keyed rig with a husky built-in power supply. Mine arrived factory wired, so I put it on 20; had WA2DNK (the generous soul who loaned his receiver) tape the QSO and play it back over the land line. We both agreed that it sounded cleaner than the commercial four-stage v.f.o. exciter in use at my home QTH and the proportion of T9X reports while signing PJ5MA spoke well for the rig and our critique.

*200 South Willow St., East Aurora, N. Y.

[1]Northernmost of the Dutch West Indies, approximately 200 mi. east of Puerto Rico.

[2]Canadian Club at $2.00 a fifth.

[3]We used antenna changeover relay and receiver muting to guard against losing the receiver's front end transistor. This necessitated a monitor which was home-brewed in a minibox for the occasion.

The Seaview Hotel. The dipole is strung just beneath the porch ceiling.

I picked up a couple of crystals for the low end of the band; assembled a dipole cut for 15 and 20 from 300 ohm line and 50 feet of submin 75 ohm coax and was ready to go. Ready except for one slight detail—licenses!

License

I had written a couple of people, who, logic told me, should be able to put me on the right track; but time was running out with no reply. Now bear with me, as I run through the following sequence: Mentioned problem to Don, W2QFC, local old timer, and confidant. He suggested contacting K2CD. Norm came up with an FS7AA QSL dating from Doc Evans' W2BBK dxpedition to Sint Maarten in 1956. Got Doc on long distance in New Jersey and Doc said "why sure, just write Vince PJ2ME in Philipsburg and he'll get the ball rolling for you". Next day dispatched air mail plea to Vince. A couple of weeks went by and yours truly entered a stage which might be termed "uneasiness". Then one evening the phone rang and W2DJW in Rochester advised that PJ2ME was on 14030 wanting a QSO with K2AAC. Made a dive for the shack, but by the time I got loaded up band went out, so still no dope. Another week went by, while I searched the bottom end of 20 every evening hoping to QSO PJ2ME. No luck. Just as I was about to push the panic button a card arrived from W2EHN text of which said "PJ2ME asked me to tell you to send photostat of US license and fourteen dollars to Director Lands Radio Dienst, Curacao".

As I air mailed bank draft, photostat and formal request for operating privileges on the Dutch side to Curacao, two somewhat sobering thoughts occurred. First, it was now January 28, which meant but three weeks to departure, and second, still no word on procedure for obtaining an FS7 ticket.

On the 6th of February a letter arrived from R. Van Haaren, Director Lands Radio Dienst, which tactfully explained that in such matters, I must proceed through proper channels—in this instance, the U.S. Consul in Curacao. Lack of reciprocity *can* be a bother. Cables were immediately dispatched to our consul, and to Van Haaren, and the serious waiting began. The next evening, who should appear on 20 c.w. but PJ2ME. Vince and I had a good rag chew, during which he confirmed that I would find 110 volt 60 cycle a.c. in the hotel mains, at least from 7 AM to 1 AM. He also told us to forget about an FS7 call as he knew of no way to get one.

On February 15 a cable arrived from Curacao—"Amateur license granted Seaview Hotel". No hint of a call—but then this was no time to get stuffy about details.

Our tickets were all set up for a flight to New York on Saturday the 18th; a 707 to San Juan on Sunday, and a final DC-3 hop to Sint Maarten, Monday morning. I could already hear the pileups.

On Thursday—the boss called and said he was sorry, and all that, but I had to be in *New York* on Monday, the 20th. I guess I was getting conditioned; didn't even argue. Simply turned over the impossible task of changing plane reservations to Sunday, Tuesday and Wednesday respectively, to the travel agent, and decided to make use of the extra day at home during the DX contest, to look for a couple of new ones.[4]

Saturday morning the travel agent called and said our revised schedule was confirmed okay but with a couple of changes in airlines. Things never looked better—until the evening paper told us of the spreading flight engineers strike. This whole affair was beginning to acquire tinges of comic opera.

Sunday found us in New York—yours truly struggling with two 15 lb. "carryons", and the wife with a somewhat oversized handbag containing bug, etc., as previously enumerated. We got there because someone had the foresight to design flight engineers *out* of Viscounts.

Repeated checks on the status of our Tuesday AM flight to San Juan kept turning up the same answer—the flight would go as scheduled with supervisory personnel subbing for the hibernating flight engineers. The story sounded

[4]Irony maybe—but FY7YF became DXCC #100.

good up until 12:30 PM, 8 hours prior to our scheduled departure, when we were advised all flights were scratched until further notice. The pileups gave way to a dead band!

For some unaccountable reason, Tuesday morning found us at Idlewild right in the middle of one of the worst tieups in the history of air transport. For some equally unaccountable reason we lucked through—with the last two seats on the final Pan AM jet headed for Puerto Rico, and by early afternoon the XYL was determinedly window shopping Old San Juan.

Arrival

About eleven the next morning we set foot on Sint Maarten, and caught a cab for the Sea View Hotel. Our reservations had been made three months previously, but you guessed it—they proved worthless in the face of the snafu resulting from the air strike. After extracting a promise that we could have a room the following day, we piled back into the cab, and soon located a room for the night.

As soon as we were settled I went down to the desk and put through a call to the local cable office (Lands Radio) to see what they knew about my license. The phone system was still recovering from the after effects of hurricane "Donna", so was reminiscent of ten meter phone moments before the band collapses altogether. All I got out of the attempt at conversation was—"see the Governor".

I wangled an interview with the Governor, who received me most cordially, and in turn set up an appointment with Herr Hooft, of Lands Radio, who would complete the business of the license the following afternoon.

Vince located us that evening at our temporary quarters, and very kindly offered whatever help I needed to get on the air.

Setting Up

The next morning, we moved to the Sea View, and I began the task of getting the rig ready so that I could make use of the ticket I hoped to get that afternoon.

The hotel was a typical tropical layout, with all rooms on the second floor. The room available turned out to be about the only one that had any convenient antenna possibilities, so before long my dipole was stretched the length of an east-west gallery upon which our room fronted. This meant the antenna was reasonably oriented to work the states but was up only 18 feet and less than 2 feet beneath a corrugated steel roof. But then, my early DXing was accomplished with an attic dipole and 75 watts, so what the heck.

The plumbing in our bath had a European heritage, but I reasoned the drain went to ground just as it did Stateside, so I made fast to same with clamp and braid. The cold water pipe, please note, ran to a cistern on the roof and hot water is still a few years off they tell me.

Getting 110 a.c. from mains to rig involved the entire chain of command at the Sea View and I must say the results were indicative of the attitude of the staff and owner, Jim Hazel, all of whom went out of their way to make our stay a pleasant one. Locating a male threaded plug to accept an American flat pronged plug proved to be quite a task on an island, which long ago adopted the European round prong plug. But find one they did, and it was with considerable satisfaction that we watched the fils come up.

Hooft provided me with a license and the information that it was renewable annually, but as a non-resident privilege was good for but a single fortnite in any calendar year. Beyond that, the PJ5 in lieu of PJ2, designated a non-resident call. All this was a surprise to me, but at least here was a brand new prefix[5] for the big rigs to zero in on.

On The Air

So finally a CQ on 14 mc at 2140 GMT Thursday put PJ5MA on the air. W2BOK gave us an optimistic 589 and we were in business.

The rest was pretty anticlimatic. Twenty was virtually dead all day every day. Would open

[5] I understand some PJ5A prefixes have been issued on Aruba, but to my knowledge, this is the first PJ5M. The MA seems to bear this out.

[*Continued on page 106*]

The 85 degree winter weather and Dutch brew helped to while away those hours waiting for the band to open.

An Economical 75 Meter Whip

VINCE AMICO*, K8LQM
AND JOE PLESICH JR.†, W3ZWH

For simplicity, low cost and ease of construction, this mobile whip is just the antenna for the ham who wants to operate mobile on 75 meters this summer

MAYBE, when the desire to go mobile overcomes you, you can scrape up enough parts in the junk box for a little converter and xmitter, but where, you wonder, will you find $20.00 for a mobile whip and mount, especially when the jr. op. needs a new pair of shoes and the XYL is screaming for a new hat. If your circumstances are similar to these and you still want to go mobile, then read on, for this economical whip is just for you.

Construction

First, scrounge up a 6 foot length of 1¼ inch dowel. Then, measure off 5 feet 3 inches from one end and divide this portion of the dowel into 3 inch sections (see fig. 1). The remaining 9 inches of the dowel will be used for mounting the antenna. Next, make little notches all around the dowel with a hacksaw at each one of these 3 inch marks. These notches will facilitate the winding of the wire.

Now that the dowel is ready for winding, take a 120 foot length of #20 to 24 enameled wire and start winding the wire at the first notch, which should be about 9 inches from the bottom end of the dowel. Wind 14 turns to cover the first inch and then spiral out 1 turn per inch for the next 2 inches. Continue winding the wire all the way up the dowel until you reach the last notch. (See fig. 1.) If, when you get to the last 3 inch section, you find that you have a little too much wire, just wind it on to fit in the space that you have left. Fasten the end of the wire in place with a tack and you are ready for mounting.

* R.D. #1, Hanlin Station, Paris, Pa.
† 303 Ross St., Steubenville, Ohio

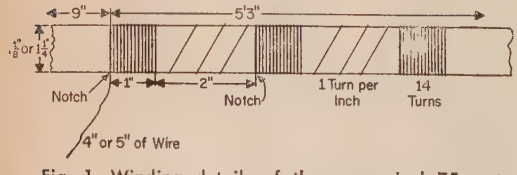


Fig. 1—Winding details of the economical 75 meter loaded whip. The winding is accomplished over 5' 3" of the 6' dowel, alternating 1" at 14 t.p.i. and 2" at 1 t.p.i.

Mounting

The whip may be mounted in any convenient manner. In my case, I just drilled two holes through the left rear bumper guard on my 1953 Ford, and, two matching holes through the bottom 9 inches of the dowel and fastened it to the bumper guard with two long bolts and nuts.

Tuning

Once your whip is mounted, you can begin the tuning procedures. Make sure the braid of the 52 ohm coax is properly grounded and that the center conductor is connected to the bottom of the whip. If the whip doesn't seem to load properly, try peeling a few turns from the top of the antenna. In some cases, just the squeezing or spreading of the bottom turns will do the trick. When it loads properly, finish it with a few coats of spar varnish or fiber glass paint, if you really want to splurge.

Tests with W3ZWH and W8ZRI prove that the "bug killer," as my XYL calls it, really works. On 75 meters, in the daytime, I was able to maintain communications with W3ZWH over hilly terrain for a distance of 16 miles, and this was with only 5 watts input! Maybe you may want to experiment with different lengths and diameters of dowel or wire, or, you may substitute plastic tubing for the dowel. Whatever you decide to do, I'm sure you will have lots of fun, and, what is more important, you will have a mobile whip for less than the price of a few crystals for the big rock crusher.

I might also add that it makes a dandy home station antenna for small lots or apartments. ■

A Practical 432 Mc Converter

BY FREDERICK W. BROWN*, W6HPH

Number one on the list for an effective 432 mc station is a good converter. Described here is a simple converter that will let you hear almost any signal that is hearable. The noise figure will equal or surpass just about anything except a good parametric amplifier.

FROM a communications viewpoint the question might be asked "why 432?". If the only desire were to escape low frequency QRM, two meters would serve the purpose as well as a higher band. But 432 mc has some merits that the lower v.h.f. bands cannot claim. Chief among these is the almost complete freedom from man-made noise. Even with the most sensitive 432 mc receiver, power leak and similar types of electrical noise are practically never heard; and, although in a metropolitan area, ignition noise is occasionally experienced, it is nowhere near the two meter level.

Another potential advantage of 432 lies in smaller antenna sizes. This benefit is partially offset by the fact that for equal operating range it is usually necessary to have the 432 mc antenna as large in area as the two meter antenna. For a given gain, however, a 432 mc antenna will displace only 1/27 the volume of an equivalent 144 mc antenna.

Circuit

Although, in theory, it is possible to attain a noise figure below 6 db with a crystal mixer alone, I have never been able to do this. Despite much experimenting with low noise mixer diodes, the noise figure usually turns out to be something more than 12 db. The absence or an rf stage also introduces i.f. feedthrough and local oscillator radiation problems which are not easy to overcome.

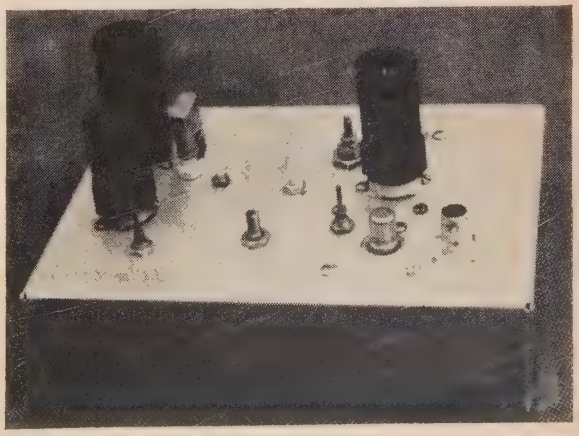
The availability of the 6CW4 Nuvistor makes it easy to obtain a low noise figure at 432. As shown in fig. 1, the 6CW4 rf. stage is followed by a 1N82A mixer. The i.f. signal is amplified by a 6AB4 cathode follower and local oscillator injection is provided by a 12AT7—6AK5 combination.

Details of the 6CW4 r.f. stage shielding are given in the photographs. Although the nuvistor was not designed for grounded-grid operation, it can be made to give stable performance if proper precautions are taken. The r.f. stage plate circuit is series tuned and inductively coupled to the 1N82A mixer.

A crystal mixer was chosen because it gives a lower noise figure and requires less local oscillator power than does a tube mixer. The 1N82A seems to be about as good a mixer as can be had at this frequency and does not have the mounting problem of microwave diodes.

The mixer i.f. output drives a 6AB4 cathode follower, providing low noise gain as well as

*Box 78, Star Route, Idyllwild, Calif.



The 432 mc crystal controlled converter. The oscillator multiplier chain is on the left with the piston capacitor, C_{15}, in front of the 6AK5. The Nuvistor is to the left of the antenna connector with the 6AB4 i.f. amplifier behind it. The piston capacitor to the left of the Nuvistor is C_4. The adjustable inductor to the left of the 6AB4 is L_5. The capacitor shaft in the center of the chassis is C_6, the mixer input tuning.

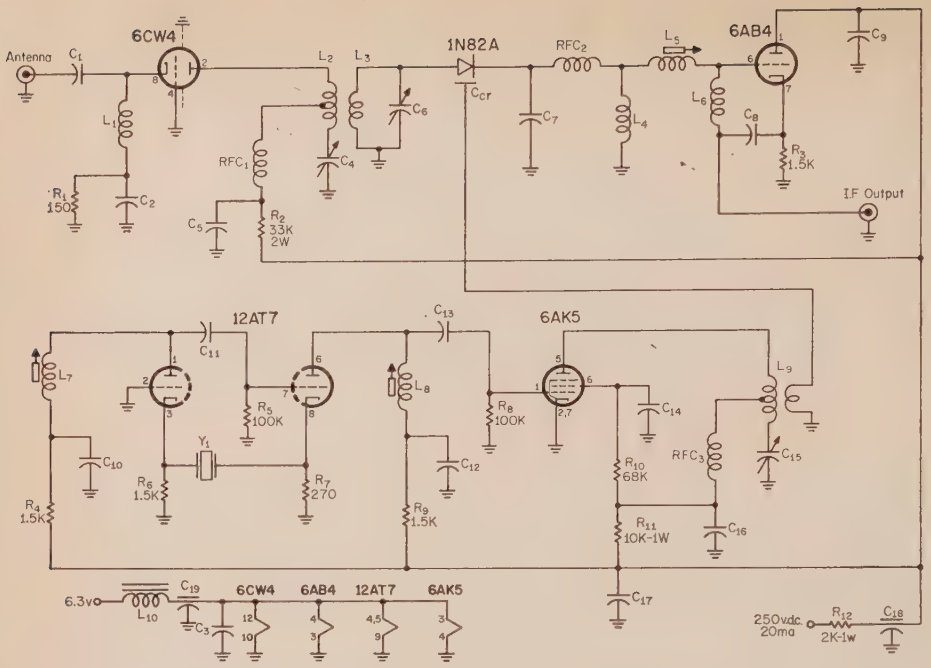


Fig. 1—Circuit of the 432 mc converter with an i.f. output of 14 mc. Details of the 6CW4 shield is shown in fig 2 and Ccr is described in the text.

C_1—50 mmf tubular ceramic.
C_2, C_3, C_5—500 mmf button bypass.
C_4, C_{15}—0.5-5 mmf piston type variable.
C_6—5 mmf miniature variable, Johnson 5M11 or equivalent.
C_7—25 mmf mica.
C_8, C_9—.01 mf ceramic.
C_{10}, C_{12}—.001 mf ceramic.
C_{11}, C_{13}, C_{14}, C_{16}, C_{17}—56 mmf disc ceramic.
C_{18}, C_{19}—.001 mf feed through bypass.
L_1—3 turns #20 E., 3/16" dia., 5/16" long.
L_2—1 2/3 turns #18 E., 7/16" dia., center-tapped.
L_3—½ turn loop #16 E., 7/16" dia.
L_4—6 microhenries. 41 turns #26 d.c.c. scramble wound on a 1 meg, ½ watt resistor.
L_5—37 turns #30 E. close wound, ½" slug tuned form.
L_6—26 microhenries, 85 turns #30 d.c.c. scramble wound on a 1 meg, ½ watt resistor.
L_7—9 turns #22 E. closewound on ⅜" dia. slug tuned form.
L_8—4½ turns #20 E. 5/16" long on a ¼" dia. slug tuned form.
L_9—2½ turns #20 E. ¼" dia., ¼" long, air wound, center-tapped. 1 turn link.
L_{10}—28 turns #30 E. closewound on a ⅜" dia. powdered iron slug.
RFC_1, RFC_2, RFC_3—8 turns #26 E. 3/16" dia, ⅜" long, air wound.
Y_1—46.5 mc (See Text).

low impedance i.f. output. This stage may not be an absolute necessity but it reduces the noise figure requirement of the receiver used for the i.f. channel. It also reduces the birdie problem by isolating the receiver from the mixer. Inductor L_5 forms an L section with the tube input capacity to give an impedance (and voltage) step-up. The purpose of L_4 is to tune out the reactance of C_7 as well as to provide a d.c. return for the diode mixer. Inductor L_6 is a neutralizing coil which resonates with the 6AB4 cathode-to-grid capacity. If the stage is not neutralized, instability may occur whenever the output is terminated in a capacitive load.

The i.f. output frequency of 14 mc requires local oscillator injection at 418 mc. This is supplied by the 12AT7 and 6AK5 in conventional oscillator-multiplier circuit. I used a 46.5 mc crystal, but a 15.5 mc crystal working on its third overtone will work as well. A 11.67 mc crystal working on its third overtone will also work provided L_7 is changed so as to resonate at 35 mc. In any case the 12AT7 will give enough drive at 139 mc for the 6AK5 tripler. The very small amount of 418 mc power required by the mixer is coupled-in by means of a stiff wire running from the link of L_9 to the vicinity of the mixer diode. Spacing between the wire and the diode is adjusted to give about 0.3 ma of crystal current.

Construction

The entire converter is built on a 5×7×2 inch chassis without crowding. The photographs give the general parts layout. Power supply leads are filtered by C_{18}, C_{19}, L_{10}, and R_{12}. These components are mounted as close to the

power connector as possible, and the feed through bypass capacitors C_{18} and C_{19} are mounted on a small bracket as shown in the photograph. Possibly less filtering would be adequate, but signals in the 20 meter region become extremely strong at times and it is best to stop them before they have a chance to get on the i.f. stage grid. A removable chassis bottom plate is used for the same reason. No trouble has been experienced with i.f. signals leaking through the r.f. stage.

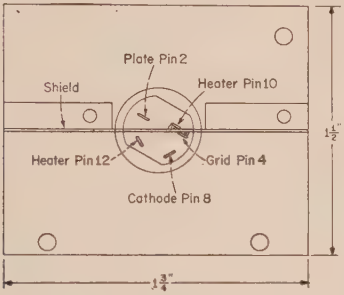
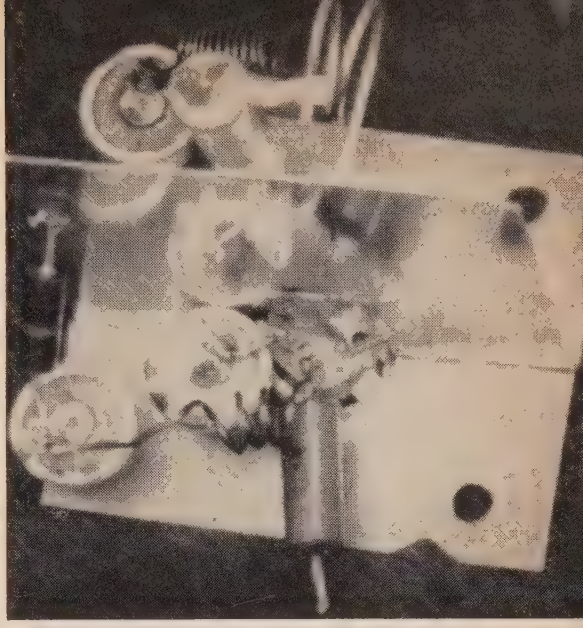


Fig. 2—Layout of 6CW4 Nuvistor r.f. amplifier. Pins 10 and 4 are soldered directly to the vertical shield.

The r.f. stage is constructed as a subassembly and then fastened to the chassis. A regular Cinch Nuvistor socket is mounted by soldering to a 1½ by 1¾ inch piece of flashing copper. The two ears on the socket mounting ring are broken off so that the ring can be brought flush with the copper. The shield may be made of tin can metal (tin plated on both sides) and should be as tight fitting around the socket as possible. Pins 4 and 10 are soldered directly to the shield.

Adjustment

First step in alignment is to get the 12AT7 Butler oscillator working properly. This is best done by listening to the crystal frequency (or harmonic thereof) with a receiver. With the 12AT7 and 6AK5 tubes in their sockets, apply heater and plate voltage. Set L_7 to a point that gives strong output and permits easy oscillator starting. Inductor L_8 can be peaked for maximum grid current in R_8. Insert a 0-1 ma meter in the ground lead of L_4 and tune C_{15} for



Close up of the r.f. stage subassembly. The input side is below the shield and the plate circuit above. Notice that the shield is bent double immediately above the socket. The button by-pass capacitor nearest the nuvisor socket is C_3 and to the left of C_3 is C_2.

maximum crystal current. You may want to incorporate a closed circuit jack at this point for easier checking of crystal current.

Next, insert the 6AB4 in its socket and connect the converter to your receiver, using shielded cable for the i.f. signal. You should now be able to tune in a strong 432 mc signal, such as the third harmonic of your two meter transmitter. Peak C_6 and L_5 for maximum S-meter reading. Then adjust the local oscillator injection to give about 0.3 ma rectified crystal current.

With a well matched 432 mc antenna connected, plug in the 6CW4 and peak C_4 for maximum sensitivity. If r.f. stage instability is noticed, increase the coupling to the mixer by pushing L_2 closer to L_3. When the antenna is removed, the r.f. stage will oscillate, this usually being characterized by an increase in noise output. Replacing the antenna should stop the oscillation. If it doesn't, further increase the

[*Continued on page 113*]

Under chassis view of the converter. The r-f. stage is at the lower left with the i.f. stage just above it. Oscillator-multiplier stages are to the right. Near the center is the mixer diode and the local oscillator injection wire is just right of it.

Converting The AN/ARC-3

BY WILLIAM B. KINCAID*

The AN/ARC-3 now widely available is converted here to an excellent two-meter station. Originally covering 100 to 156 mc, this unit requires no r.f. modifications, and the crystal controlled transmitter is left intact. Conversion of the crystal controlled receiver to continuous tuning is also included.

WHEN the Air Force, at long last, sounded the death knell for the C45 aircraft and these ships started arriving at the salvage depots in large numbers, it was an indication that the much sought after ARC-3 radios would soon become available in large quantities. Two years ago these sets would have brought over two hundred and fifty dollars; now they are available for less than thirty dollars.

The eight channel AN/ARC-3 and its modified counterparts, the ARC-36 (sixteen channels), and the ARC-49 (forty-eight channels), have seen fifteen years of continuous service and doubtless will see many more. They have been installed in almost every kind of vehicle and aircraft from jeeps, gas trucks, and APUs to fighters, Goonie Birds, 123s, and commercial carrier aircraft.

Basically, the ARC-3 is a modernized SCR 522 but with more channels, a better tuning system, a more sensitive receiver, a more powerful transmitter, and much better stability in receiver and transmitter. It is designed to transmit and receive a.m. signals on any of eight crystal controlled channels in the 100 to 156 mc Band.

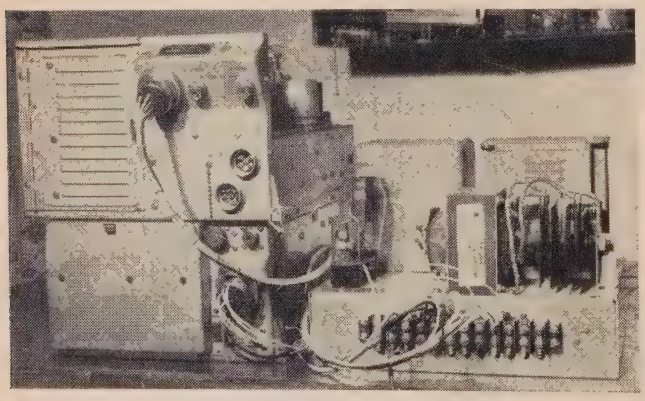
*I. F. Transformer Product Line Manager, Aladdin Electronics, Nashville 10, Tenn.

The receiver is a single conversion superhet with an i.f. of 12 mc. The crystal oscillator/multiplier chain employs multiplications of from 11 to 18 times, depending upon the frequency to be received. For the 144 to 148 mc band, crystals between 8250 kc and 8500 kc are required. To calculate the crystal for a particular frequency in the two meter band, subtract 12 mc and divide by sixteen. The crystal should be cut to operate into a 25 to 35 mmf load.

The receiver tube lineup is a 6AK5 r.f. amplifier feeding a 9001 mixer into three 12SG7 i.f. amplifiers and a 12H6 detector. Two 12SN7s, a 12A6, and 12SL7 are used in the squelch, a.n.l., a.v.c. and first and second audio amplifiers. A 9002 is used as the crystal oscillator and is followed by five 6AK5 multipliers. A 12SH7 controls the auto-tune system. Receiver specifications are as follows:

RECEIVER

Antenna *Z*	50 Ohms.
Audio Output *Z*	Hi, 600 Ohms.
	Lo, 30 Ohms.
Primary Power Input	24 Volts d.c., 1.45 A.
	210 Volts d.c., 125 Ma.
Sensitivity at 146 Mc	3.48 μv for 10:1 *s/n*.



Front view of the converted ARC-3 receiver (top), transmitter and power supply. The Amperite time delay relay can be seen on the left in front of the 5U4. The crystal selector switch shown in fig. 2 was added after the picture was taken.

A.v.c. Characteristics..10 to 1000 μv=6 db, max.
Selectivity .....335 kc at −6 db.
Squelch Range.....0-10 μv.
A.f. Response.....3 db, 300 to 4000 c.p.s.

Transmitter

The ARC-3 transmitter also has eight channels, is crystal controlled and auto tuned. The crystal multiplication, for any output frequency, is eighteen times. Thus, for two meter operation crystals lying between 8000 and 8222 kc are required. Again, as in the receiver, the crystals should be cut for operation into a 25 to 35 mmf load.

The tube line up is a 6V6 crystal oscillator driving a 6V6 multiplier which drives an 832-A push pull tripler which drives an 832-A final amplifier. The modulator consists of a 6J5 driving push pull 6L6s. There is also a 6V6 sidetone amplifier and tone oscillator and a 12SH7 auto-tune control tube. Technical specifications are as follows:

TRANSMITTER

D.c. Power Input.....30 Watts.
R.f. Power Output.....10/15 Watts at 146 Mc.
Primary Power Input. 24 Volts d.c., 2.4 A.
410 Volts d.c., 325 Ma.

Auto-Tune

The auto-tune system employed in the ARC-3 is quite accurate and useful. In the transmitter it is only necessary to plug in a crystal of the desired frequency and the set will automatically tune itself up. In the receiver the same is true except that it is necessary to preset the eight thumb wheels (behind the front panel) to the approximate frequency to be used. The thumb wheels are necessary to prevent the receiver from tuning up on an undesired harmonic.

Electrically, the transmitter tune up follows this procedure. First let's assume that the channel A selector button has just been pressed. In the instant when all of the crystal selector relays are not energized, 24 volts passes through the normally closed contacts of all the crystal relays which are connected in series. In the transmitter this 24 volts is applied to relay K_{107}, which upon closing, locks itself closed by the application of 24 volts from one set of its own contacts, and simultaneously causes relay K_{108} to close which in turn causes K_{117} and K_{102} to close. Relay K_{109} then closes connecting the channel A crystal to the oscillator. With the application of B plus from the closing of K_{102}, relay K_{103} in the plate circuit of V_{105} (12SH7) will close, start the tuning motor, engage the clutch, and release the brake. Thus, the tuning system is put into operation. The tuning capacitors, being calibrated and tracked over only 180 degrees of rotation, must be prevented from stopping on the "back" 180 degrees. To accomplish this, cam O_{101} is provided and causes switch S_{101_A} to open in the "back" 180 degrees which in turn prevents the stopping of the tuning motor until after cam O_{101} *opens* S_{101_B}. Switch S_{101_B} momentarily causes relays K_{107}, K_{108} and K_{117} to open. This is to prevent the tuning motor from continuing to operate if no crystal is in the socket or some other malfunction occurs. As the tuning motor continues to run, the tuned circuit in the grid of V_{104} (832-A) passes into resonance and a negative grid bias is developed across R_{123} and R_{124}. This grid bias is applied to the grid of V_{105}, the 12SH7 control tube, and causes its plate current to decrease which, in turn, causes relay K_{103} to open thus stopping the tuning motor, releasing the brake and disengaging the clutch.

In the receiver the sequence is almost the same in that the application of 24 volts to the set causes relay K_{206} through K_{215} to momentarily apply 24 volts through the normally closed contacts of its s.p.d.t. section to relay K_{204} which in turn closes K_{205} and locks itself closed. When V_{207}, the 12SH7, draws plate current, K_{201} closes, starts the tuning motor, engages the clutch and releases the brake. Cams O_{201} and O_{202} along with S_{201} and S_{202} prevent tune-up in the uncalibrated portion of the capacitor rotation. When the crystal oscillator harmonic generator circuits become tuned to a harmonic of the crystal, grid current flows in the harmonic generator V_{206} which places a bias on the grid of V_{207} causing relay K_{201} to open which thus stops the tuning motor, etc. To prevent the set from tuning up on the wrong harmonic, thumb wheel selectors are provided which short circuit the screen of V_{205} to ground except when the tuning capacitor shafts are turned to the frequency selected on the thumb wheel.

Conversion to 117 Volt Operation

To convert the units to 117 volt operation, no real modifications of the equipment are necessary with the exception of increasing the audio output so as to provide sufficient volume to drive a loud speaker. The conversion really boils down to building a power supply and making up some interconnecting cables and a control box.

If no plugs are available to fit the receiver and transmitter, a make-shift connector can be made from old tube sockets that have the round metal type contacts by breaking these apart and pushing them over the banana plug pins of the transmitter and receiver. By pouring liquid silicone rubber or similar material into the socket a make shift plug can be made or, if desired, the tube socket contacts can be soldered directly to the banana pins and left

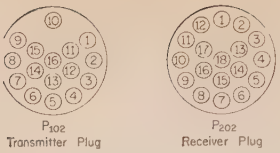


Fig. 1—Pin arrangements of the power plugs for the receiver and the transmitter.

permanently attached thereto. Figure 1 shows the location of the pins for P_{102} and P_{202}.

The power supply diagrammed in figure 2 will supply all the voltages necessary to operate both the receiver and transmitter including intermittent operation of the auto-tune drive motors and the relays. One point worth mentioning is the use of an Amperite thermal delay tube in the 5U4GB Filament. This is to prevent B plus from being applied to the transmitter and receiver while the tubes are cold. If this does happen, the transmitter will come on, the tuning motors will start, and the set may tune itself up incorrectly.

Disabling The Auto-Tune

If the set is to be used primarily to receive and transmit on one frequency only and it is desired to prevent the auto-tune mechanism from operating each time the set is turned off and on, the auto-tune feature can be disabled by tuning the set up, on channel A, to the desired frequency and then inserting a small piece of cardboard between the two top most contacts (the s.p.d.t. set) of the crystal selector relays K_{206} in the receiver and K_{109} in the transmitter. Access to the relay contacts can be had by removing the two relay cover screws accessible through the crystal compartment door. Disabling these two relays will prevent recycling of the auto-tune relays thus preventing the set from retuning itself each time power is applied.

Manual Tuning

Manual tuning of the set can be accomplished by releasing the two spline set screws on the collet between the motor right angle drive and the clutch, and shifting the collet so as to permanently engage the motor to the tuning capacitor drive. The small knurled knob on the motor can then be used to manually tune the set. This procedure is the same for both the transmitter and receiver.

Inceased Audio

To increase the audio output to a level suitable to drive a loudspeaker, move the end of capacitor C_{294}, which is connected to the junction of R_{277} and R_{278}, over to pin 2 of V_{215}. This defeats the voltage divider formed by these resistors and thus applies full audio voltage to the system.

To remotely control the squelch on the receiver it is necessary to connect a wire from the arm of the squelch control R_{272}, to pin 10 (an unused pin) of plug P_{202}. Turn R_{272} fully clockwise. A 5K pot connected between pin 10 of plug P_{202} and ground (as shown in fig. 2) can then be used to remotely control the squelch threshold level.

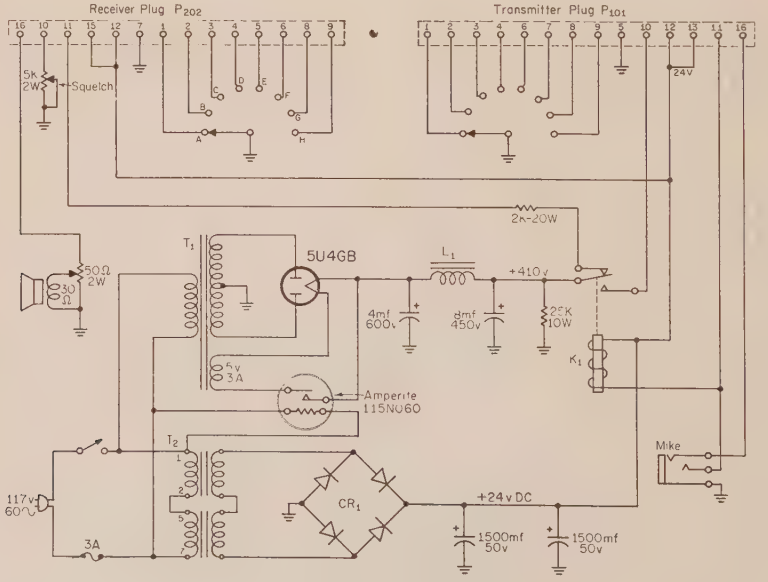


Fig. 2—Diagram of the power supply and remote control for use with auto-tune operation.

CR_1—Bridge rectifier, 36 volts a.c. max @ 4.8 amp. International Rectifier J29B5.
K_1—s.p.d.t. relay, 24 v.d.c. coil.
L_1—5 h @ 325 ma.
T_1—800 v.c.t. @ 325 ma, 5v @ 3A.
T_2—29.7 v.a.c. @ 6A. Stancor RT204.

Increased Transmitter Output

The transmitter power output can be increased considerably by changing the 832A final amplifier to an Amperex 6252. The increased efficiency of the 6252 will, in many cases, almost double the actual power output into the antenna. No changes in the transmitter are necessary other than to retune the grid and plate circuits slightly. A 5894 may also be used but it will require changing of the tank and grid coil inductances to obtain tracking.

The large can directly behind the crystal bank in the transmitter is a barometric gain control on the microphone amplifier so that the modulation level varies with altitude. It can be removed and the gain control operated manually if desired.

12 Volt Operation

For 12 volt operation the auto-tune feature will not operate reliably in that the clutch and brake solenoids will not function without hair line adjustment. Permanent disabling of the auto-tune mechanism may be accomplished in the receiver by bending the relay contacts of K_{206} so that the contacts are in the closed position at all times. If FT-243 crystals are going to be used, the socket for V_{207} (the auto-tune control) can be used as a crystal socket by removing the leads between pins 1 and 3 and 3 and 5, connecting the crystal lead from pin 6 of V_{201} to pin 3 on V_{207} socket, and plugging the crystal between pin 3 and 1 on the V_{207} socket. If this is done, the entire crystal relay bank and sockets can be removed.

Receiver Conversion

To disable the auto-tune in the transmitter, bend the contacts of relay K_{109} in the closed position. Unplug K_{103} and K_{105}. All the other relays seem to work fine on twelve volts with no modifications.

To convert the transmitter filaments for twelve volt operation:

1. Remove the white wire with brown tracer from pin 1 of V_{103} and reconnect it to pin 7 of V_{103}. Ground pin 1 of V_{103}.
2. Remove two white wires with red and black tracers which connect to pin 2 of V_{107}. One of the wires connects to R_{130}, a large 10 watt resistor. Clip and remove this wire. The other wire should be connected to pin 7 of V_{108}. Ground pin 2 of V_{107}.
3. Locate R_{129}, a 10 watt resistor located near V_{101}. Remove the wire which connects one end of R_{129} to pin 2 of V_{101}.
4. Locate R_{131} and connect a jumper across its terminals.
5. Locate R_{132} (a tapped 10 watt resistor) and connect a jumper between the center terminal and the end where 3 white wires connect.
6. Locate R_{138} and connect a jumper across its terminals.

To rewire the receiver filaments for 12 volt operation, proceed as follows:

1. Remove the white wire with brown tracer from pin 7 of V_{216} and reconnect it to pin 8 of V_{216}. Ground pin 7 of V_{217}.
2. Remove the white wire with brown tracer from pin 8 of V_{215} and reconnect it to pin 7 of V_{215}. Ground pin 7 of V_{215}.
3. Remove the white wire with brown tracer from pin 2 of V_{210} and reconnect it to pin 7 of V_{210}. Ground pin 2 of V_{210}.
4. Remove the white wire with brown tracer from pin 7 of V_{207} and reconnect it to pin 2 of V_{207}. Ground pin 7 of V_{207}.
5. Remove the white wire with brown tracer from pin 3 of V_{203} and ground the wire. Connect a jumper wire from pin 5 of V_{201} to pin 3 of V_{203}.
6. Remove the white wire with brown tracer from C_{204} on the oscillator/multiplier chassis and reconnect it to C_{206}. Ground C_{204} by bending its center pin over and soldering it to the frame.

Transmitter Alignment

Test points have been provided, connected to P_{101}, located on the front panel, which are intended for use with test set TS-178/ARM-1. This test set consists of a 50 μa meter, a selector switch, a 1 meg resistor and a 10 meg resistor. The 50 μa meter is connected directly across each test point pin and ground for all test points except for the A+ and B+ terminals where the 1 meg and 10 meg respectively are connected in series with the meter.

The chart in Table I indicates the terminal to which the 50 μa meter should be connected, the approximate meter reading obtained, and the adjustment to be tuned.

Table I

Meter to Ground and	Tune	For	Current
Pin 1			10-35
Pin 2	C_{108}	Max	12-45
Pin 3	C_{115}	Max	12-45
Pin 5	C_{122}	Max	
Pin 6	C_{129}	Min	
—	C_{130} & L_{109}	Max r.f. Output	

The two adjustments, C_{130} and the output coupling link, L_{109}, can be adjusted for maximum output in the two meter band but a compromise adjustment is necessary for tracking the 100 to 156 mc spread.

Receiver Alignment

As in the transmitter, test points have been connected to plug P_{201}.

Crystal Oscillator Alignment—With an 8727 kc crystal installed and a 50 μa meter connected between pin 1 of P_{201} and ground, turn the adjustment in Z_{201} as far counter clockwise as possible then clockwise until the meter reads 25 μa.

Fundamental Amplifier Alignment—With an 8100 kc crystal installed and a 50 μa meter

connected between pin 2 of P_{201} and ground, turn all three screws on the top of T_{201} all the way counterclockwise. Turn first one and then the other of the outer two screws clockwise a turn at a time until maximum meter reading is obtained. Turn the center screw for maximum. Check on other crystal frequencies to be sure meter reads above 20 μa on all crystals. Repeat if necessary.

Harmonic Generator And R.F. Alignment—Tune a signal generator to the frequency to be received. Be sure that the right harmonic is used, or better yet, use a weak received signal if one is available. Connect the 50 μa meter to pin 5 of P_{201} and ground. Adjust C_{219E} and C_{219D} for maximum reading. Set the squelch control to the edge of noise/silence and adjust C_{247E}, C_{247F}, C_{247G}, and C_{247H} for maximum opening of the squelch. Keep the signal generator output as low as possible during these adjustments.

I.F. Strip Alignment—The i.f. strip used on the ARC-3 is purposely broad. To accomplish the wide bandwidth it was necessary to employ slightly overcoupled i.f. transformers. If an attempt to align the i.f. strip is made simply by adjusting all the i.f.s for maximum output, the symmetry of the i.f. response curve will be destroyed. To properly align this type of i.f. it is necessary to load the primary winding with a resistor so as to "kill" its Q while tuning the secondary. Killing the Q removes the loading effect from the winding being adjusted and thus eliminates any detuning effects caused by the over coupling.

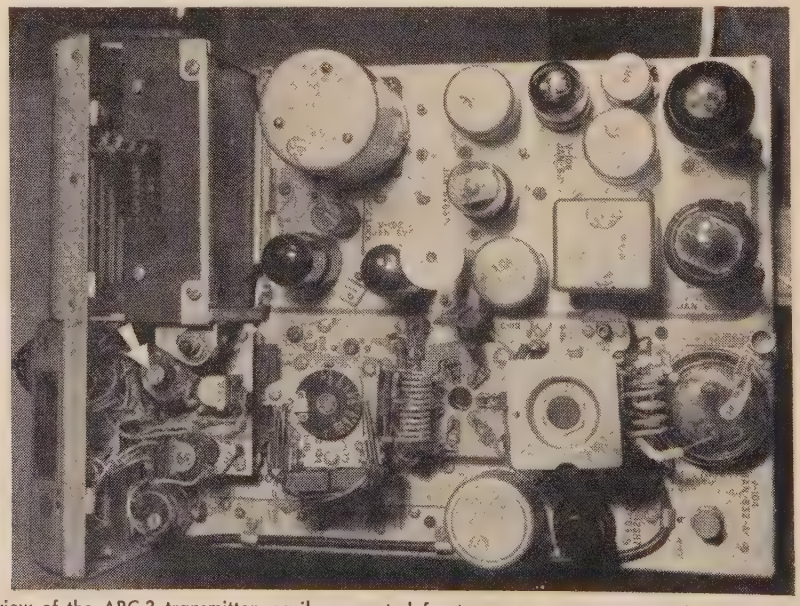
To tune the ARC-3 i.f.'s it is necessary to connect a 680 ohm resistor in series with a 470 mmf capacitor across the primary when tuning the secondary and vice-versa. To be sure the i.f.'s are aligned on exactly 12 mc, use a BC-221 frequency meter or a crystal controlled signal generator to establish the 12 mc signal. Connect the signal generator to a floating (ungrounded) tube shield placed over V_{209} and adjust the i.f.'s as described above for maximum opening of the squelch or for maximum output as indicated on an audio output meter.

Service Notes

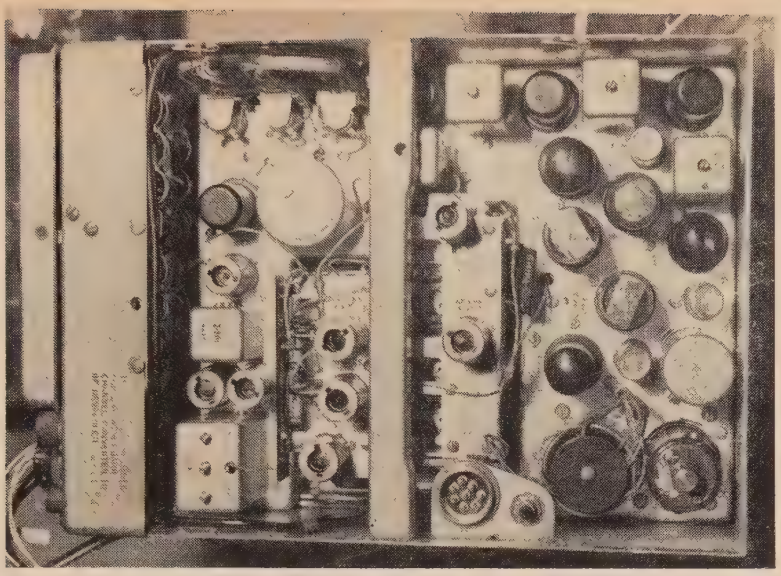
Failure of the squelch control to work and severe overloading can often be traced to C_{292}, a 0.05 mf 200 v moulded capacitor. This large capacitor is located at the back of the receiver with one lead grounded and the other connected to a terminal on the rear apron of the chassis. In four out of five sets checked, this capacitor was faulty.

Tunable Receiver

The receiver can be made tunable by converting V_{204} to a tunable oscillator. This is done by disconnecting the wire connected from T_{201} to pin 5 of V_{204} and connecting a 10K resistor from pin 5 to ground. Next, connect a 50 mmf capacitor from pin 5 of V_{204} to the junction of C_{220} and R_{219}. In some sets it may be necessary to adjust C_{220} either up or down in value to obtain the correct feedback for stable oscillation of V_{204}. Voltage regulation of the B+ for V_{204} will aid the stability somewhat.



Top view of the ARC-3 transmitter, easily converted for two-meter amateur use. The arrow indicates the knurled knob which is used to manually tune the channel selector in lieu of "auto-tune" operation. The Barometric gain-control, referred to in the text, is the large round component at the top left. The round calibrated dial indicates the approximate r.f. operating frequency.



Top view of the ARC-3 receiver chassis. The knurled knob for manual tuning is located atop the motor in the lower right corner. Plug P_{201}, the test plus, is located to the right of the crossbar. When converting to continuous tuning the wiring changes are made in the area of V_{204}, the bottom tube on the multiplier subchassis to the left of the crossbar.

By making the receiver tunable and connecting the control tube grid (V_{207}) to the a.v.c. line, a "signal seeking" receiver can be made. Connected in this manner, the receiver will hunt for a signal unless a.v.c. voltage is high enough to bias V_{207} to cutoff.

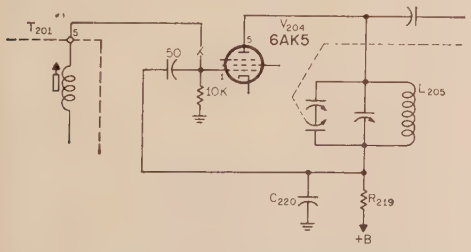


Fig. 3—Circuit modifications to convert the receiver to continuous tuning.

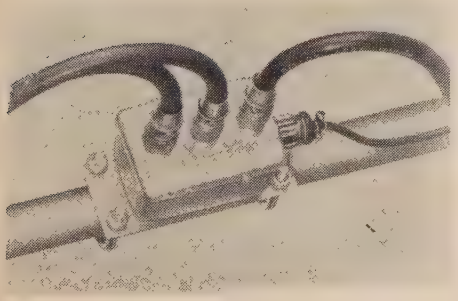
S Meter

For an S meter, a milliameter can be connected in series with R_{255}, the screen resistor for V_{211}, in the conventional fashion. Other S meter circuits can be adapted if desired. The current range of the S meter should be from 0-1 ma with a suitable shunt to zero the meter under no-signal conditions.

Rack Mounting

Both the receiver and transmitter are suitable for rack mounting by turning them sideways and mounting them on six two inch standoffs placed between the side panel and the rack panel. The two inch setback will allow a speaker, on/off switches, and other controls to be mounted between the panel and the set. ■

New Amateur Products



Coaxial Relay

BAY-ROY Electronics announces the new "All-Weather" coaxial relay for quick antenna switching. This unit mounts on antenna tower or mast, and will handle a full one thousand watts, a.m., c.w. or s.s.b. Standard units come supplied with coaxial cable connectors and power plug. The unit may also be used as a transmit-receive switch and can be mounted anywhere indoors or outdoors. Units are available for 115 volt a.c., 6v. or 12v. d.c. use. For more information, check B on page 118.

A Single Sideband Exciter

BY DURWARD J. TUCKER*, W5VU & J. L. COPELAND†, W5SQT

The design and construction of an s.s.b. generator was described in a previous CQ article. This second article covers the v.f.o., mixer, r.f. amplifiers, vox and the power supply. The exciter has an output of 15 watts p.e.p. on 40 and 80 and economy and simplicity of design, without compromise of performance, was adhered to as in the original article.

In our previous article[1] it was pointed out that by mixing the 1600 kc s.s.b. signal with a v.f.o. output which tuned from 5.1 mc to 5.7 mc, a product signal of 6.7 mc-7.3 mc (the sum of 1600 kc and the v.f.o.) and a product signal of 3.5 mc-4.1 mc (the difference between the 1600 kc and the v.f.o. signal) can be obtained. In one heterodyning operation we have converted our 1600 kc s.s.b. signal to frequencies that fall both in the 40 and 80 meter amateur bands. We may choose any of these frequencies by tuning a circuit or circuits to the desired frequency.

Mixer Design

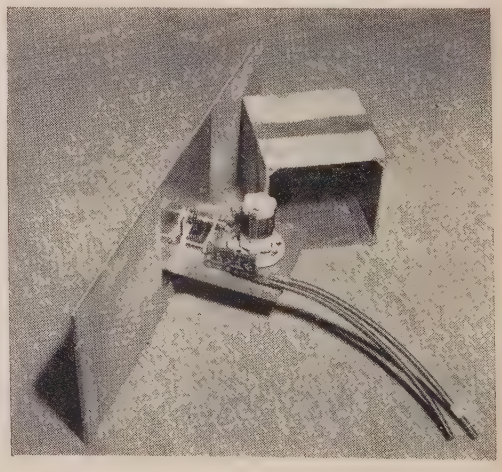
For our use we chose the 6BA7 which is a tube especially made for mixer service. It has moderate gain as well as a very high plate impedance which is desirable so that it will not load the tuned circuit in the plate enough to alter the *Q* of the circuit. It also has one grid into which the 1600 kc s.s.b. signal is fed and another grid into which we feed the v.f.o. signal. The characteristics of this tube are such that the s.s.b. signal should be fed in at a level of from .1 volt to not over one volt; the lower values being preferable. The oscillator signal should be fed into the 6BA7 at a level from 2 to 10 volts, always keeping the ratio of the two signals at about 1 to 10 or more respectively. By keeping to this ratio the spurious signals generated tend to be of lower amplitude with reference to the desired frequencies.

V.F.O. Construction

Any self-excited oscillator, to be stable, must be of very rigid mechanical construction regardless of the circuit used. Since rigid boxes and shields are not available to amateurs through the usual wholesale channels it was decided to have these parts cast from patterns which were built by a local pattern maker and the castings poured at a local foundry. These castings are of aluminum and consist of a box which is approximately 5″×5″×5″ with one end open. The sidewalls and bottom are ¼″ thick. The shelf on which the tuning circuit is mounted is a flat cast aluminum slab type box 4″×4½″×½″ thick, with the bottom (4″×4½″) open. The sides and top walls are ¼″ thick. These dimensions produce a very rigid mounting for all v.f.o. circuitry and makes for easy construction and assembly.

The shelf, in turn, is fastened to a ⅛″ aluminum panel by three 6-32 machine screws which are tapped into the shelf itself. The shaft of the tuning capacitor passes through a hole in the panel so that it clears and does not touch the panel. A Millen midget type 10039 dial is used to tune the capacitor and this dial is fastened to the panel. This gives a very rigid as well as a simple type of construction.

The 5″×5″×5″ box acts as a shield for the tuned circuit and fits over the shelf with enough



In the v.f.o. assembly all components are mounted on the cast base. The tuning capacitor shaft passes through the front panel and the band set capacitor may be seen to the rear left of the coil. The complete assembly provides shielding and heat stability.

*6906 Kingsbury Drive, Dallas, Texas
†P. O. B. 110, Wolfe City, Texas
[1]Tucker, D., Copeland, J.L. "Single Sideband Generator Design," *CQ*, August 1960, page 26.

clearance so that it does not touch the shelf or parts. This box is also fastened to the panel by four 8-32 screws which thread into four tapped holes in the corners of the box. The shield box and shelf weigh a total of three and one-half pounds.

Capacitor C_3 is an air type vernier tuning unit of about 50 mmf that tunes about 8 kc for 180° of rotation. This capacitor can be placed at any remote point and connected back to the tuned circuit through a piece of coaxial cable. The control may be seen under the right hand side of the main tuning dial and is designated FINE TUNING. The panel markings are 1 kc divisions. It is shunted across C_6, the 820 mmf silver mica capacitor that is in the ground side of the tuned circuit. The principal use of the capacitor is for "zeroing in."

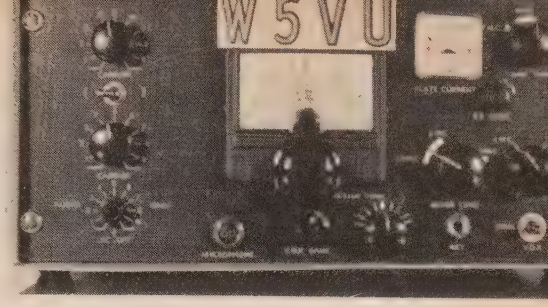
All v.f.o. grid circuit leads shown in fig. 2 should be kept as short and rigid as possible. The coax leads to the oscillator tube can be of any convenient length and do not greatly affect the oscillator frequency. The same holds true for the coax that connects C_3 to C_6.

Inductor L_4, the plate coil, is self resonant and is scramble wound on a slug tuned form adjusted so that it is resonant at about 5.4 kc. This coil is shunted with a resistor of about 600 ohms after the coil is tuned to resonance. The purpose of this coil and resistor combination is to keep the v.f.o. output nearly constant over its entire tuning range.

6BA6 R.F. Amplifier Stage

A 6BA6 was chosen as the r.f. amplifier because its gain can be controlled by varying the bias. Also, this tube has a low plate to grid capacitance making it easy to stabilize. A variable cathode resistor of 25,000 ohms was used as an r.f. gain control in this stage in order to control the r.f. output of the exciter.

The plate of the 6BA7 mixer and the plate of the 6BA6 amplifier are gang tuned by a pair of 190 mmf capacitors. With this value of capacity the coils tune to 80 meters on the maximum capacity end and to 40 meters with



Front view of the sideband exciter. The three controls and toggle switch on the left are sideband generator controls and are, from top to bottom, Carrier Null, Sideband Selector, Carrier Null and Audio Gain. The bottom row contains the Microphone Input, Vox Gain, Fine Tune, Key Jack and Vox Switch, S_1. The control above the key jack tunes the mixer and r.f. amplifier plates. The 3.5 to 4 mc position is to the left and 7 mc to the right. The control above the vox toggle is the tank coil switch, S_2, with the 4 mc setting on the left. Counter clockwise rotation brings it to 7 mc. The control to the right of the meter is the 2E26 Plate Tuning capacitor and just below the meter is the R.F. Level control.

about ¼ the maximum capacity. This avoids band switching in this circuit. However, when changing bands, do not stop the tuning capacitor near the center of its range or it will amplify the v.f.o. signal. By calibrating this control it can be set on either the 40 or 80 meter end of the scale. Attention is directed to the photograph of the front panel and the control designated as MIXER TUNE. One should determine the operating area for both the 40 and 80 meter bands, labeling them carefully as we did. Then one should be sure that this control is always set in the appropriate area at all times as cautioned above.

The 2E26 Stage

The 2E26 tube was chosen for the exciter final. It is directly coupled to the plate tank of the 6BA6 amplifier which is capacitively coupled to the plate. With the grid circuit of the 2E26 well isolated from the plate circuit no neutrali-

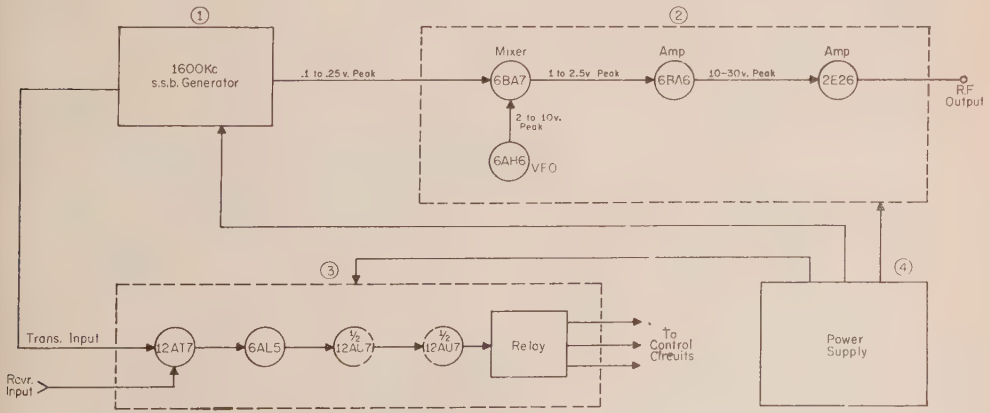


Fig. 1—Block diagram of the s.s.b. exciter. Units 2, 3 and 4 are described in this article while unit 1, the sideband generator, was described in CQ for August, 1960.

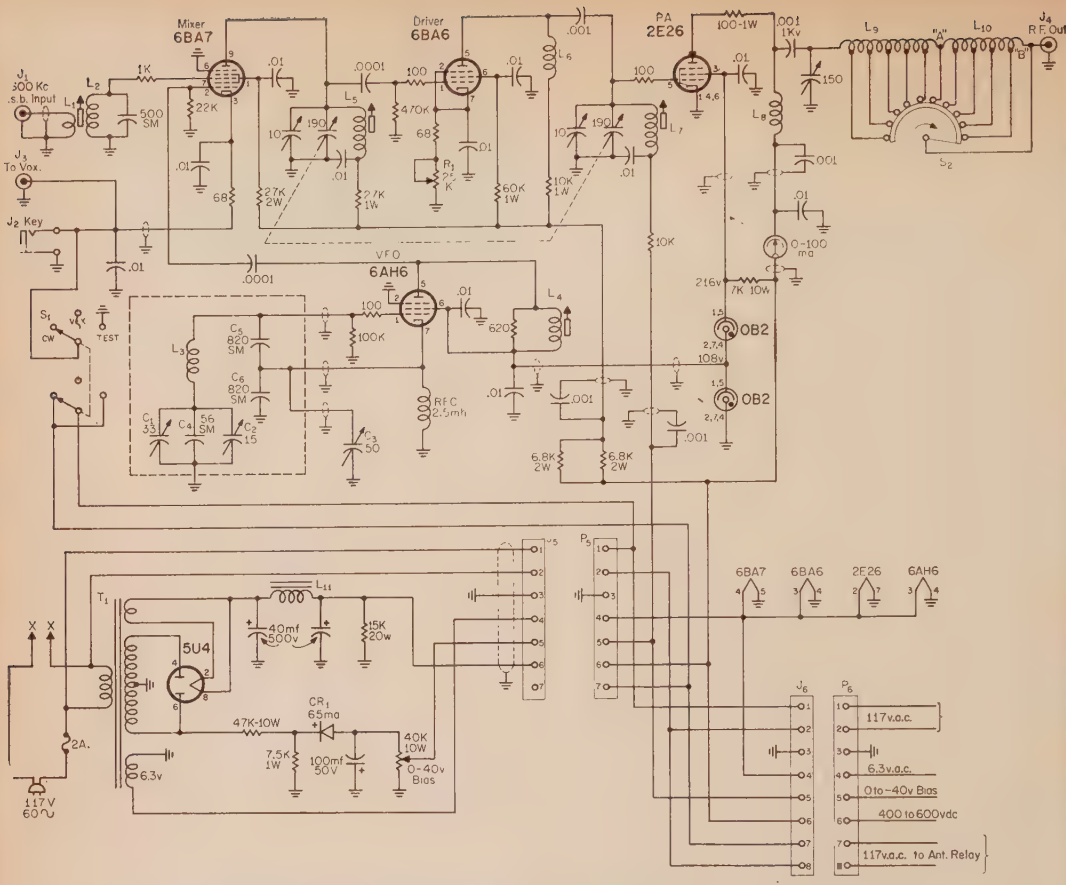


Fig. 2—Circuit of the r.f. and power supply portion of the exciter. The 1600 kc s.s.b. input from the generator is fed to J_1 and the amplified output on the 40 and 80 meter bands is taken from J_4. The 216 volt regulated output from the top of the 0B2s is fed to the 1600 kc crystal oscillator in the sideband generator. The power supply output voltages are fed to the exciter through a 12" length of 6 conductor cable and a 9 pin female plug. All resistors are ½ watt unless otherwise marked. All capacitors greater in value than 1 are in mmf and less than 1 are in mf unless otherwise noted. Points "X-X" connect to the On-Off switch in the s.b. generator.

R_1—25K wire wound, 5 w, linear taper.
L_1—3 t #22 on cold end of L_2.
L_2—45 t # 30 e., close wound on National XR50 form.
L_3—20 t, #24 heavy formvar on a 1⅝" ceramic form or a National XR60 with the slug removed.
L_4—80 t #32 heavy formvar wire, scramble wound on a ¼" × ½" surplus ceramic slug tuned form.
L_5, L_7—32 t #24 e., close wound on XR50 form.
L_6—2.5 mh r.f.c., iron core. Millen J300-2500.
L_8—2.5 mh r.f.c. National R-100U.
L_9—23 t, B&W #3016, tapped every turn from point A for 5 turns (7 mc coil).
L_{10}—23 t, B&W #3016, tapped every two turns from point B for 10 turns (4 mc coil).
L_{11}—6 h @ 200 ma. Triad C14X or equivalent.
S_1—3 position d.p.d.t. (center off) toggle switch.
S_2—1 pole 12 position shorting, steatite insulation. Centralab PA-2000 or equivalent.
T_1—700 v.c.t. @ 165 ma., 5 v @ 3a, 6.3 v @ 5a. Triad R-16A or equivalent.

zation is required. The plate circuit is an L network rather than the usual pi because it is easily built and adjusted for loads of from 40 to 70 ohms. The loading is adjusted by taps on the inductance and tuning of the plate capacitor.

With 400 volts on the plate, 216 volts regulated on the screen, and the grid bias set so that the plate idling current is about 20 ma, the power output, in class AB_1, is about 10 watts p.e.p. with an input of about 16 watts p.e.p. The required grid drive, in peak r.f. volts, is about 24 volts.

The bias supply is made variable so that the 2E26 can be operated in class A or class AB_1. For minimum distortion, where not more than 1 to 4 watts is required, set the bias so that the idling current is about 30-35 ma and reduce the drive until, when talking into the mike in a normal tone, the plate milliameter shows only a slight flicker. If more power is desired then the input can be raised to about 25 watts p.e.p. by raising the plate voltage to 600 volts and setting the bias so the idling current is 20 ma. The stage is then operating at its max-

imum rating in class AB_1. The plate current on voice peaks should never exceed about 40 ma (average should swing from 30 to 40 ma) while talking normally.

Review of the Generator

Attention must be called to three circuit drafting errors. The positive end of one of the 10 mf capacitors should connect to the transformer (T_1) end of the 22K resistor instead of the other end of the 22K resistor as shown. The .01 mf disc ceramic bypass to ground was omitted from the bottom (power supply end) of the oscillator plate coil L_1. The coupling capacitors to the bridge of the r.f. phasing network are .0005 mf instead of .005 as shown.

Alignment

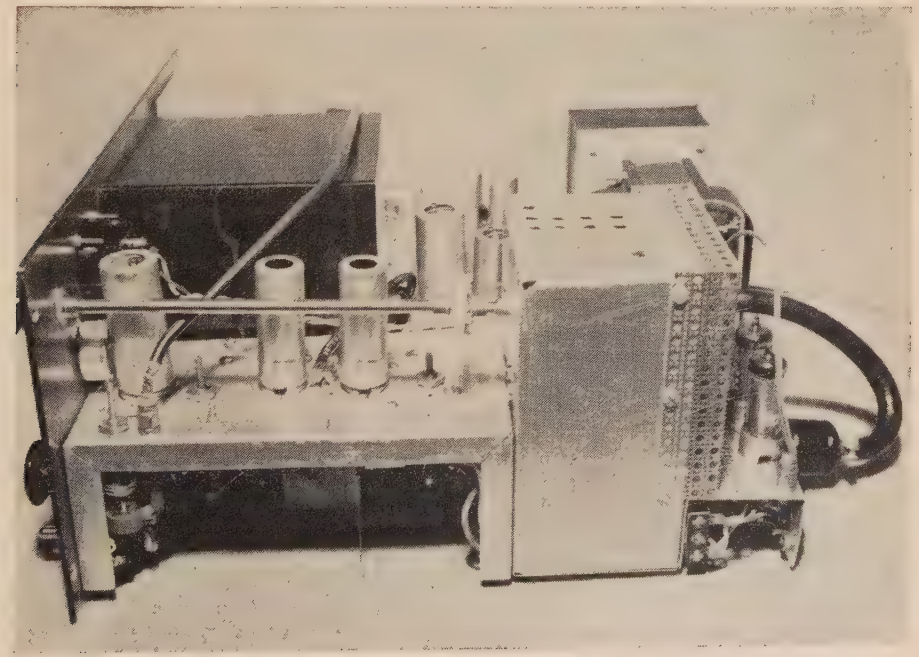
With a grid dip meter, check the plate coil of the mixer stage for resonance at 3.5 mc with the tuning capacitor set at 90% of its maximum capacity. Now, remove all the tubes but the 6BA7 mixer, remove the signal input, and place a milliameter in the B plus lead to observe the current while tuning the capacitor through its entire range. If no variation is noted the mixer stage is stable (no self oscillations present).

Remove the 6BA7 tube and place the 6BA6 amplifier tube back in its socket and repeat the procedure as outlined above for the 6BA7 mixer stage. If the 6BA6 stage is stable we are now ready to test the 2E26 stage.

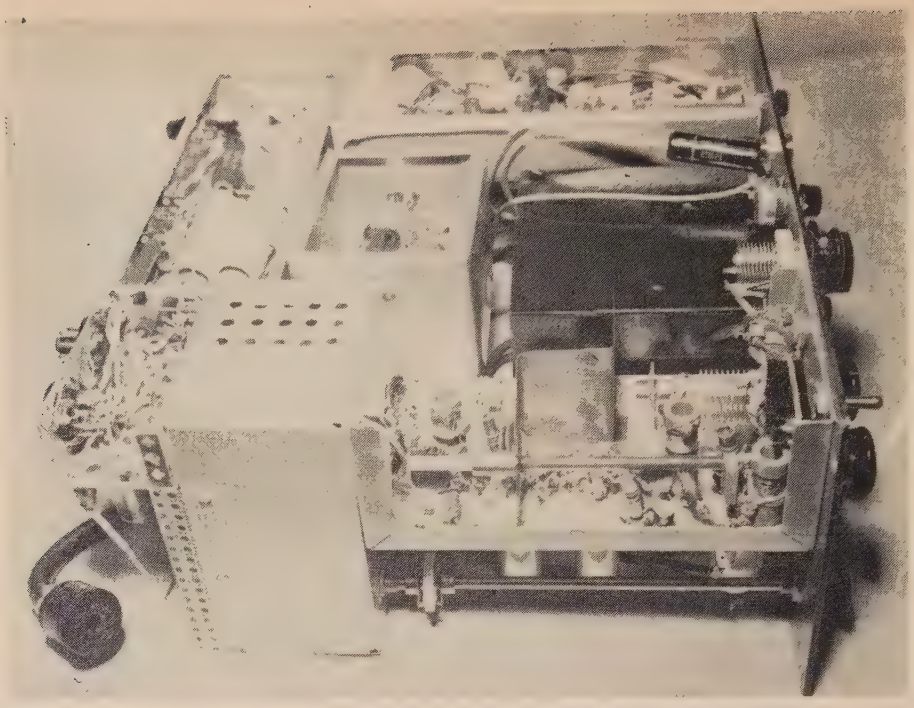
Remove the 6BA6 from its socket (in order to test the 2E26 stage) and place the 2E26 in its socket and connect a 50 ohm resistor across the output; set the bias voltage so that the tube draws about 20 ma. Check for plate current variation as the 2E26 plate capacitor is tuned through its entire range. There should not be the slightest variation in plate current. If care has been used in the assembly shielding and wiring then all of the stages will be found to pass this stability test. Be sure that the 2E26 stage is always loaded when checking.

Now place all the tubes in their socket and load the 2E26 stage. With one of the carrier pots unbalanced, measure the r.f. voltage at the 6BA7 mixer grid (pin #7) with the vacuum tube voltmeter. Adjust the balance pot on the sideband generator until no more than one volt is obtained. Be sure that the sideband generator is functioning properly; that its tuned circuits are properly peaked and that the grid input coil (L_2) of the 6BA7 is also properly peaked. Now measure the r.f. voltage from grid #1 (pin #2) of the mixer stage to ground. This should be in the range of 5 to 10 volts r.m.s.

Set the station receiver on 3.5 mc and, with the v.f.o. capacitor C_1 tuned near its maximum capacity, a signal should be heard. Now set the v.f.o. tuning capacitor C_1, at about 95% of its capacity and set the v.f.o. FINE TUNING control,



Side view of the exciter showing the r.f. section. The left chassis houses the mixer, v.f.o. and r.f. amplifier. The tube order from l. to r. is, 6BA7, 6AH6 and 6BA6. The sideband generator input to the mixer is located on the front left edge of the chassis. The attached chassis, shielded with the perforated aluminum, contains the 2E26 and plate circuit. The extension couples to the 2E26 plate tuning capacitor. The small rear chassis holds the two regulator tubes and the power plugs. The corner plug connects the vox unit.



Bottom view showing the r.f. chassis of the exciter. The 2E26 plugs into the socket mounted on the rear wall and is ventilated by the holes drilled in the cage. This affords excellent isolation between input and output of the final. The dual ganged 190 mmf r.f. tuning capacitor may be seen separated by the shield plate. The 15 mmf variable, Fine Tuning, is located over the v.f.o. housing.

C_3, at one half capacity. Then tune the capacitor, C_2, for zero beat with the receiver.

Now move the receiver to 3.6 mc and zero beat again. Repeat this for every 100 kc from 3.5 to 4.1 mc carefully (without touching C_2), marking the v.f.o. dial each time you zero beat.

To provide the v.f.o. with a slower rate of tuning, the 8:1 ratio would have to be increased and this would require a more expensive dial. This problem was solved electrically by shunting one of the 820 mmf capacitors with a variable capacitor (C_3) and this control is called V.F.O. FINE TUNING. A change of 50 mmf or so would give an overall change of approximately 8 kc.

Now place the v.t.v.m. (for r.f. measurements) across the 50 ohm load resistors in the output of the 2E26 stage. Set the tuning capacitor at about 90% of its capacity and adjust the slugs in the plate and grid coil of the 6BA6 stage for maximum output. The output can be adjusted to peak value by adjusting the tap on the output coil of the 2E26 stage and tuning the plate capacitor of that stage. The plate current to the 2E26 stage should be kept below 50 ma. The r.f. level can be controlled by the pot and in the cathode circuit of the 6BA6 stage. It is not necessary to drive the 2E26 stage to maximum output for this alignment procedure; only enough output is necessary to give good indication, say 10 volts or so.

Now set the v.f.o. tuning control at approximately its 4100 kc position as indicated by the preliminary calibration described above. The v.f.o. will now be on approximately 5700 kc. Tune the mixer plate and r.f. amplifier capacitor so that it is set near the minimum capacity. In so doing you will notice strong signals when you pass through the 5700 kc point on the tuning range. This point will be past the middle of the tuning range. Also the third harmonic (4,800 kc) of the 1600 kc s.s.b. signal will show up near the middle of the range. The fourth harmonic, at 6400 kc, will give a weak signal also. It is obvious that these signals are undesirable and care should be taken to see that the tuning capacitor is not mistakenly set in a position where these signals will be amplified. Near the minimum capacity end of the tuning range you will find the desired signal at 7300 kc and it will give a strong output in the receiver. Be sure to carefully mark this point on the panel after (and only after) it has been carefully identified. This signal will not be as strong as the 3.4 mc signal on the preliminary alignment.

This signal can now be peaked with the trimmer capacitors (the two 10 mmf units across the tuning capacitor C_0 and C_0) and will then be very strong. The r.f. level control will have to be backed off to keep from overdriving the 2E26 stage.

Now return the v.f.o. tuning capacitor to the

3500 kc position on which it was originally set and retune the 2E26 stage for 3500 kc output. Repeat this procedure several times until the circuits track satisfactorily. When the circuits are tracking, the r.f. level control will usually have to be backed off more for the 7 mc band than for the 3.5 mc band to give the same amount of drive to the 2E26 stage. Care should be taken not to drive the 2E26 stage beyond the class AB_1 mode of operation.

This completes the circuit alignment for the exciter but a more accurate v.f.o. FINE TUNING calibration procedure is required before operating. This is done as outlined below.

Set the FINE TUNING capacitor at half value (plates half out). Mark this position as zero on the indicator. With the receiver set on 3900 kc, zero beat with the main v.f.o. tuning control. If your receiver is calibrated in one or two kilocycles, reset the receiver at 4 kc higher in frequency and zero beat the v.f.o. with the receiver using the fine tuning control. Mark this point on the dial or panel and divide the space between zero position and the 4 kc position to get one kilocycle division. Now set the receiver 4 kc lower than 3900 and repeat the procedure.

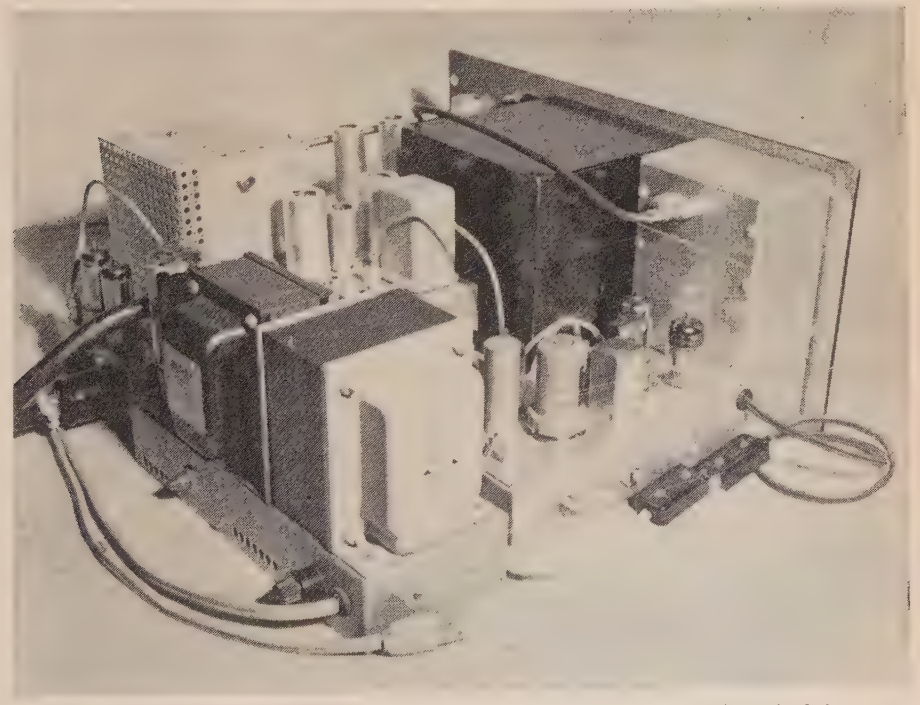
An alternate method can be used as follows: with the s.s.b. suppression upset, set the receiver as 3900 and zero the carrier. Now insert a 1000 cycle tone from an accurately calibrated audio generator. Tune the receiver to the two signals first the one below 3900 kc which will be 3899 kc and then, with the fine tuning control on the transmitter, zero beat this signal. Mark this position on the fine tuning indicator dial. Now move the receiver to the 3901 kc signal and repeat the procedure of zero beating with the fine tuning control on the exciter and mark this position on the fine tuning indicator. Repeat the above procedure for 2000 cycles, 3000 cycles, 4000 cycles respectively and your fine tuning indicator is calibrated.

Construction

Elaborate mechanical construction details, except for the v.f.o. have not been given because so many hams build with what they have on hand rather than follow the mechanical details to a letter. Adequate pictures have been included which clearly show the unit construction, the assembly arrangement of the units that go to make up the exciter, and the construction of the various units.

Power Supply

The pictures show several views of the power supply and the circuit is given in fig. 2. It has



Rear view of the exciter. The sideband generator is located on the right end of the front panel with the v.f.o. enclosure to the left. To the rear of the v.f.o. enclosure is the vox chassis. The power supply is the chassis directly behind the vox and sideband generator while the rear chassis is the r.f. section. The r.f. output connector is on the side of the 2E26 shield just forward of the perforated shield. The cable connecting the power line switch, located in the sideband generator, to the power supply, is visible in the foreground. The bias adjust control is located on the power supply chassis, beneath the choke.

been pointed out that more power can be obtained from the exciter by putting 600 volts on the plate of the 2E26 instead of the 300-400 volts as suggested. This can readily and most economically be done by changing the rectifier circuit from full wave to a bridge type. In that case the high voltage to the 2E26 can be obtained from the full output of the bridge rectifier and the low voltage to all the other tubes can be supplied in the conventional manner from the power supply. The total drain of the exciter under average conditions, including the vox, is 115-125 ma. If it is contemplated that a mixer will be added for the other bands in the future, then one should allow for a total power drain of from 175 to 190 ma.

VOX

The vox circuit was published in a previous *CQ* article.[2] The circuit is shown in fig. 3.

A line-to-grid (500 ohms to 50,000 ohms) transformer was added in the receiver input from 0.1 mf coupling capacitor to ground. The "transmitter in" connection of the VOX was connected to J_2 (marked VOX OUT) as shown in the circuit diagram of fig. 5 of our generator article.[1]

A surplus three pole double throw sealed relay was used instead of the s.p.d.t. shown in the original vox article. Our relay has a coil resistance of 6,500 ohms. The three double throw poles provide for doing just about everything that normally needs to be done. The following functions are performed in operating the exciter under full vox control:

1. The exciter and power amplifier is keyed.

2. The speaker is disconnected from the receiver and a 10 ohm resistor is placed across the receiver output when the transmitter "keys."

3. The 117 v.a.c. is supplied from the auxiliary power plug on the rear of the exciter to an external antenna change-over relay each time the transmitter "keys."

4. Extra bias may be supplied to the power amplifier to bias it beyond cut-off during listening intervals (when transmitter is off). This extra bias, in turn, is removed each time the transmitted is voice keyed. This provision is built into the Johnson 500 used by the author.

5. In addition the vox prevents loudspeaker signals from keying the transmitter. Only words spoken into the microphone key the transmitter.

None of the vox controls are critical to adjust and all are positive as to their proper function. A vox adds to the cost of the exciter but it more than vindicates its cost in the operating pleasure that it provides. The vox can be readily identified in the pictures as the small chassis just to the rear of the v.f.o. box.

S.S.B. Operation

With the exciter aligned and a dummy load (made of three 2 watt 150 ohm resistors in parallel) across the output, balance out the carrier by adjusting the carrier pots while observing the output on an output meter or a vacuum tube voltmeter as described. Now, with the carrier out, turn up the audio gain and speak into the mike. The output should kick up from zero to about half of what it was with carrier.

Now remove the microphone and feed in an audio tone of 1000 cycles per second to the microphone jack. Adjust the audio input and the audio gain control until the output indicated across the dummy load is about what it was with the carrier. With the receiver set up for single sideband signal reception, tune in the signal. If the s.s.b. generator is in good adjustment there will be two signals about 2 kc apart. One will be much stronger than the other, 5 to 8 S units. If not, or if you desire to check for maximum s.s.b. suppression, tune in the weakest signal as indicated on the S meter, or by ear, and carefully readjust the pots on the left side of the s.s.b. generator for a minimum signal. Now switch the s.s.b. switch marked 1 and 2 and the signals should increase from 5 to 8 S units. Repeat the process for each sideband and your s.s.b. exciter is ready to go.

[*Continued on page 96*]

[2]Tonne, J. L., "Sure-Fire Voice Break-In," *CQ*, June, 1958, page 38.

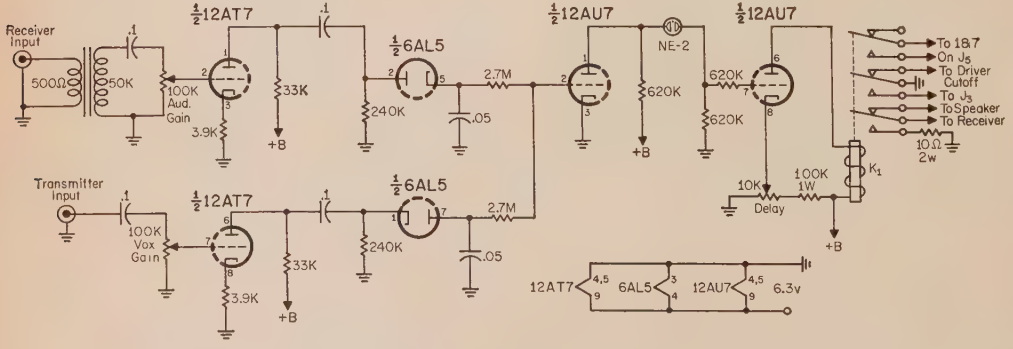


Fig. 3—The vox circuit shown controls many functions through the use of the 3 p.d.t. relay. The transmitter input is taken from the sideband generator chassis. The vox gain control is located on the exciter panel while the other two controls are on the vox chassis.

CQ Reviews:

The Multi-Elmac AF-68 Trans-Citer

BY ART SEIDMAN*, K2BUS

It was with obvious enthusiasm on my part that I accepted the new Multi-Elmac AF-68 to review for *CQ* magazine. Being an owner of its predecessor, the AF-67, I have great admiration for the performance of this transmitter. It is not too often that a ZS6 will climb into the American portion of the 10 meter phone band and call you to ask, ". . . are you really mobile OM?" When I came back to assure him I was mobile, his next remark was, ". . . you are putting down here one of the most beautiful signals I ever heard from any station." And this kind of praise was experienced more than once in working DX.

Circuit Description

Before discussing the differences between the AF-67 and AF-68, a description of the AF-68 will be presented. The AF-68 is a self-contained bandswitching transmitter covering six bands: 80, 40, 20, 15, 10, and 6 meters. It offers the ham the choice of a.m. or c.w. operation. Although the unit is commonly used for mobile work, it can be employed in the home station as a "barefoot" transmitter (60 watts input to the final) or as an exciter for a high-power rig. A universal power supply (M-1070) is available for 6 and 12 volts d.c. and 115 volts a.c. operation.

The dimensions of the AF-68 are 13¼ inches wide, 6½ inches high, and 7½ inches deep, excluding the projections of the control knobs. Power supply requirements are as follows. Filaments: 6 volts @ 5.2 amp. or 12 volts @ 2.6 amp. a.c. or d.c.; plate supply: 500 volts max. @ 160 ma and 250 volts max. @ 75 ma.

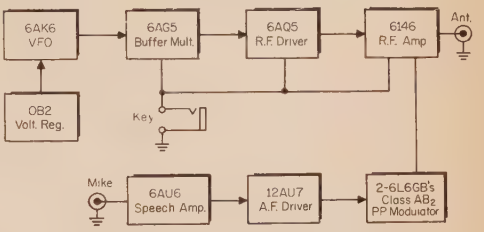


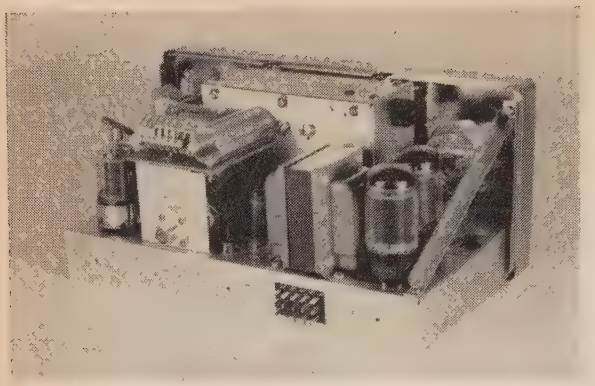
Fig. 1—Block diagram of the AF-68 Trans-citer.

A block diagram of the AF-68 is shown in fig. 1. The v.f.o. is shielded and employs a 6AK6 in a Hartley circuit. The plate and screen voltages of this tube are regulated by an 0B2. Provision is also made for crystal operation (two crystal sockets are available). A 6AG5 is used as a buffer-multiplier. The 6146 final r.f. amplifier is driven by a 6AQ5. Maximum power input to the final is 60 watts. A pi-network in the output permits matching to antennas of 50 to 300 ohms impedance. When in the c.w. mode of operation, the buffer-multiplier, driver, and final are all keyed together.

For a.m. operation, the AF-68 can be used with a carbon mike, or high impedance mike such as a crystal. The speech amplifier employs a 6AU6 followed by a 12AU7 driver. A pair of 6L6GB's are used in a class-B push-pull plate modulator. Bias for this stage is provided by a 22.5 volt battery which is permanently mounted in the transmitter.

*238-73 116th Road, Elmont, L.I., N.Y.

Front view of the AF-68. The controls are, bottom row, l. to r., Meter Switch, V.F.O. Spot, Mike Jack, Key Jack, Power, Grid Tuning. Above the Grid Tuning are, Load Tuning and Plate Tuning. Mounted on the main tuning dial, upper left, Mode Switch, upper right, Audio Gain, lower left, V.F.O. Control, lower right, Bandswitch.



Rear view of the AF-68. The final 6146 is on the extreme left. To the right of it are the final coils with the coax antenna connector underneath. To the right of the output coils is the modulation transformer with the 6L6 modulator tubes alongside. The v.f.o. enclosure is in the rear against the front panel and the power connector is on the rear chassis flange.

AF-67 and AF-68 Differences

The above circuit description, in general, also applies to the AF-67. There are, however, a number of differences which will now be examined.

1. Perhaps the most significant change is that the AF-68 makes possible 6 meter operation. The AF-67 offered the 160 meter band instead —which is certainly not very practical for mobile operation.

2. The AF-67 provided narrow-band f.m. (n.b.f.m.) operation. This mode has been eliminated from the AF-68.

3. Dimensionally, the AF-68 is about 2 inches longer than the 67, but is ¾ of an inch less in height and 1 inch less in depth.

4. The meter on the panel of the AF-68 is illuminated. This was not true for the AF-67.

5. The crystal sockets in the AF-68 are not easily accessible. In the AF-67, they were mounted on the front panel.

6. The band-switching mechanism for the AF-67 consisted of sprockets and a Boston #1 ladder chain. This has been replaced by a bevel gear arrangement in the AF-68.

7. Styling and construction of the AF-68 are excellent. The panel is charcoal and grey with chrome trim around the cabinet. The wiring is very clean and neat; excellent workmanship.

The above differences are summarized in Table I.

	AF-67	AF-68
1. Bands	160-80-40-20-15-10	80-40-20-15-10-6
2. N.B.F.M.	Present	Eliminated
3. Dimensions	11¼x7x8½	13¼x6½x7½
4. Panel meter	Not illuminated	Illuminated
5. Crystal sockets	Accessible from the front panel	Not accessible from the front panel
6. Band switching mechanism	Sprockets and ladder chain	Bevel gears
7. Styling	Good	Excellent
8. Control functions	A.M., N.B.F.M., C.W., controlled from rear	Front panel controlled

Table I—Summary of the differences between the AF-67 and AF-68.

Operation

The AF-68 is easy to load up. In fact, it can probably load into a wire coat hanger. The v.f.o. appears to be very stable. It was found that a low-pass filter effectively suppressed any TVI present. In short, the AF-68 is a real performer. It should afford great satisfaction to the user in either mobile or fixed-station operation.

Multi-Elmac M-1070 Power Supply

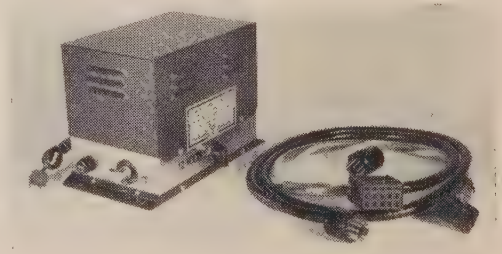
The M-1070 power supply may be classified as a universal supply which can operate from 6 and 12 volts d.c. and 115 volts a.c., 60 cycles. It can power a transmitter and/or receiver. Its overall dimensions are 9½ inches wide by 6⅜ inches high by 5⅛ inches deep. Construction of the unit is in heavy gauge steel and the workmanship is excellent. All top components on the chassis are completely enclosed under a louvered cover.

The following voltages and currents are available from the M-1070 supply:

+500 volts d.c. @ 250 ma; 50% duty cycle.
+250 volts d.c. @ 75 ma; 50% duty cycle.
+250 volts d.c. @ 100 ma continuous.
6 volts @ 8.5 amps or 12 volts @ 4.25 amps continuous for filaments.
+105 volts regulated @ 20 ma continuous.
+6 or +12 volts d.c. @ .3 amp for external relay applications.

A single heavy-duty vibrator is employed for 6 and 12 volt d.c. operation. The rectifier circuit is a full-wave bridge with two series-connected silicon diodes in each leg of the

[*Continued on page 95*]



View of the AF-68 power supply and harness cable.

DX DX DX DX DX DX DX DX

URBAN LE JEUNE, JR., W2DEC
BOX 35, HAZLET, NEW JERSEY

The following certificates were issued between the period from November 12th, 1961 and December 5th, 1961:—

CW-PHONE WAZ

1613	W7QNI	Paul A. Wolf
1614	OZ7KV	Kaj V. Andersen
1615	ZK1AK	Norman N. Walding
1616	W1CV	E. J. Martineau
1617	OH9NC	Jouko Jujala
1618	ZL3AB	Leslie C. Evans

ALL-PHONE WAZ

100	WØQVZ	Robert M. Kelley
101	CX2AX	Miguel Bialade
102	UC2AA	V. K Benzar
103	W2VCZ	Robert Stankus
104	VK4FJ	Sidney Roy Baxter
105	W2FXN	Robert C. Scully

ALL SSB WAZ

18	W7PHO	W. H. Bennett
19	W8PQQ	Albert H. Hix
20	VQ4ERR	E. Robson
21	WØQVZ	Robert M. Kelley
22	W8BF	J. O. Barimgardner
23	OE1RZ	R. O. Zlamal
24	W2VCZ	Robert Stankus
25	W2FXN	Robert C. Scully

CW WPX

226	OH9NC	Jouko Kujala
227	G3GSZ	J. S. Tempest
228	SM7TV	Boris Goransson
229	W8NAN	Walt Enz
230	W9OVF	Harry G. Butler
231	W9KA	Roy W. McCarty
232	UA3BN	Nicholas Stromilov
233	W1YPH	Leona Peacor
234	VE6VK	R. A. Wilson
235	UA6LF	Eugene W. Filippov
236	K9GTK	Thomas Ivas
237	K4OMR	Raymond H. Porter
238	VK3RJ	Ray E. Jones
239	W3REL	Clayton R. Brown
240	EA2CR	Jose M. Almenara
241	W1UOP	Roger C. Paulson

PHONE WPX

44	UR2BU	Karl Kallemaa

SSB WPX

85	VE6VK	R. A. Wilson
86	W1UOP	Roger C. Paulson

MIXED WPX

4	W9KA	Roy W. McCarty

MCing

Just a few short lines before we give this subject a well deserved rest. I mentioned in a recent column that the DX adapter for the KWM-1 is no longer available from Collins Radio. WØUIM wrote in to offer the use of his DX adapter for DXpedition use. His address is Gaylune Elliott, 2619 Wilkes Ave., Davenport, Iowa. Thanks a million Budd. Wayne Cooper K4ZZV, ex YN1WC/HR2WC offers one for sale or trade to any interested party.

Now off the MC soap box for at least another month.

Here and There

AC5: AC5PN has been active weekends on 14075 kc from 1230 to 1330 GMT. W8PQQ has his logs up to November 18th.

CR8 Goa: Vasco Da Gama the QTH from which CR8AC operated in the residential section of the town of Mormugoa in Western Goa. HB9QP/CR8 was also in Goa. So, W2DEC goofs again. (Tnx WGDXC)

FW8 Wallis Island: The November trip of FK8AS has been postponed until April due to administration difficulties. (Tnx WGDXC)

JZØ Netherlands New Guinea: Henry Worthington, JZØHW, is flying for the Missionary Aviation Fellowship in Netherlands New Guinea. He is based at Geelvink Bay. His operating hours are very limited. He comes into the west coast between 0000 and 0300 GMT on 21,320 kc. He is on a.m. with a Valiant as he is not permitted to operate s.s.b. in Netherlands New Guinea. (Tnx W6DLN)

LA Jan Jayen: The following stations are on from this spot LA2NG/P, LA8YB/P, LA7JF/P, LA1LP/P and LA1LG/P.

LA Spitzbergen: LA2DE/P and LA1DF/P are on from this spot. (Tnx Florida DX report)

TL8 Central African Republic: TL8AC has been very active lately between 14050 and 14090. The best time for the states has been between 1900 and 2200 GMT. He is very slow on c.w. so hold your speed down to 5 to 8 w.p.m. TL8's AA, AB, and AE have been active on 21 mc a.m.

TR8 Gabon: TR8AB has been active on occasion on 21250 kc a.m. 5N2AMS/TY2AA has been unsuccessful in obtaining a ticket as we go to press.

VP8 South Orkneys: VP8EG, who is ex G3LM, should be coming on s.s.b. about the time you read this. He has a 500 watt rig for s.s.b. on c.w. He will be there for 2 years. (Tnx W1CKA)

VS9 Maldives: The following interesting letter was received from Bill, VS9MB.

"The operating position is a little bleak at the present time. Dave has returned to G and I am, at present, the only operator.

"We do get visits from VS1KQ, 1KP, 1KS and 1KY every few weeks and they are very active from this QTH for about 10 or 14 days at a time but in the meantime, I handle all the operating.

Bill, VS9MB, at the operating position. See the story on VS9MB in the text.

"I have been over to G for a spot of leave and only returned last week. The XYL presented me with a brand new son & heir (wife and baby, o.k.) and W1RLQ (Grace), W1QDO (Henry) in mass along with K5MJW (Betty) and W5GNK (Doc) are the boy's Godparents. They will sure see he grows up a 'ham'. On my return to the station, I found 1400 letters and cards awaiting me and I am at present up to the neck in replying. Dave did send out a lot of cards for his contacts and now cards for those same contacts are rolling in. A lot of the boys are sending in IRC's for direct replies but as Dave had already sent the QSLs off via ISWL, I find it impossible to send off duplicates direct. Sorry about that but the QSLs will arrive in time and I'd hate anyone to think that we are fiddling the IRCs but on a station like this the QSL situation is fantastic and once we get a backlog, it is a heck of a job to catch up. So be patient fellows, we'll get them out as fast as possible.

"When I get back (after 7 weeks absence) the TX and RX were both off the air and five heartbreaking days were spent finding and fixing the faults. I am back on the air now but am still having quite a time with some trouble in the modulator and driving stages and it would appear that old age is rapidly catching up on the TX. Any day now I expect to blow up and I've had it. This is such a heck of a place to try and get spares and replacements and the TX has had such rough and long usage that anything can happen.

"Still, she manages to put a 5/9 into the States and we can keep our fingers crossed. I enjoy very much my stateside QSOs and heartily endorse everything Dave said about the boys and, of course, the girls, hi. Funny thing, even on a dead band (no Ws) I still get my nightly QSOs with Grace, W1RLQ and OM K4SKI and my very good friend, Charlie in Greenville, N. C. always looms in here during his lunch hour. I just need to put out a CQ and tune about 5 or 10 kc to work either of them FB. So there you are fellows, I'm on, are you, hi.

"We are still in the dark about the s.s.b. rig and unless Dave heard anything while I was away, nothing has been heard for months now.

"Since I got back on the air 3 days ago, 15 meters has been a real good band for DX and I have heard some rare ones working into W quite well. 4S7YL is getting into W with 40 watts and a long wire, OD5CU is very active so is VS1DO. I've heard 6W8S, ZB1, TN8, VS5 and, of course, old Angus 5N2AMS, so there is plenty of good DX around 15 at about 1400 to 1700 GMT. If any of the boys want to give me a call, I'll always be happy to let them know what I can hear from this end.

"The picture enclosed is of myself, at this load of nuts and bolts we get out on.

"Cheers for now, oh, by the way, when writing it is better not to put name and rank on the address. Letters are likely to chase the person named after he has left here if the surname and rank shows. It does help to sort out cards if the APO name shows on the envelope but letters and QSL cards are only likely to chase all over if 'CPL. Jeapes' or 'LAC Sykes', etc. is included. I will be around here 6 months before going 'G' and after that can only hope for another exotic one, hi.

"Once again, cheers and good luck to all my friends and all hams over there. Here's looking forward to working you all."

ZD1 Sierra Leone: Charlie Marks has returned to ZD1 and should be starting up as ZD1CM. (Tnx WGDXC)

ZD8 Ascension Island: ZD8JP has been active on 14019 kc around 2000 GMT.

ZS2 Marion Island: Look for ZS2MI on Sundays at 1400 GMT on 14056 kc long path. (Tnx Florida DX Report)

ZL4 Campbell Island: Ian Johnson, who operated from this rare spot during 1960, returned to the Island several weeks ago. Fortunately he was able to regain his old call of ZL4JF—fortunately, because the Post and Telegraph Dept. (FCC) had re-allotted the call. The new holder of the call was quite happy to let him have it back again, and the authorities had no objections. At present he is busy studying for another technical examination and building the

Doc, SM5BPJ and his neat station in Stockholm.

Heathkit SB-10. He hopes to be active on 20 and 80 again early in 1962 on s.s.b.—possibly on a.m. and c.w. a little earlier. His Collins 75S-1 should arrive soon so that difficulties in the receiving department should be at a minimum. He was anxious to go to the Kermadec Islands for this tour of duty, but his counterpart on that Island decided to "sign on" for a second tour and he is not a ham. Entirely new QSL cards have been printed and they are a collectors' item apart from their DX value. QSLs again go to ZL2GX who will handle this side of the chore. Operating frequency will most likely be at the "bottom" end of the band, 14120 or so, to avoid the QRM at the high end. (Tnx WGDXC)

3V8 Tunisia: The following from 3V8CA via K6BX: "I am on s.s.b. and c.w. on the following freqs: 14.050, High end of the 14 mc phone portion, 21.050 and around 21.4. Operating times are from 1900 GMT on, during week days and on weekends starting around 1300 GMT. I use a KWM-2. Also on 7 and 3.5 around 2100 GMT when the higher freqs are useless. Which is quite often now-a-days.

"Please delete the 3V8 QSL Bureau QTH. Francois De Vichi passed away over a year ago. At that time I notified the postal authorities here to send all correspondence such as QSL cards to me. I also notified the call book people of this and stated that since I was the *only* authorized ham in the country I would act as QSL Bureau. 3V8 stations that were on the air here 3 or 4 years ago have departed. So far, I have found two former 3V8 hams. Neither one of them active."

4W1 Yemen: 4W1AA has been on for a few times recently. It is reported that he is an ok and that he is good, but I don't have any definite information. 14096 kc seems preferred.

HKØ Baja Nuevo: An expedition to Baja Nuevo is being planned by HK1QQ, W6HAW, W4DQS, and Co. (Tnx Florida DX Report)

VK9 Land: Nauru: VK9's AM, and DJ. Cocos Keeling: VK9's HC and BB. Norfolk: VK9GP. Papau VK9RO. Christmas Island: VK9MV. (Tnx Florida DX Report)

This neat rig belongs to W3PGB. Scotty was awarded the certificate in the center by the Government of Peru. (*QST* Aug. 1960, p. 10)

VP7BO and VP7BQ operating at the Missile Range Station on Grand Bahama Island. The fellows operate on all phone bands. (Tnx VP7BQ)

VKØ Mac Quarie Island: VKØ's FZ and RF are active from Mac Quarie all other VKØs are in Antartica. (Tnx Florida DX Report)

ZD6 Nyasaland: ZD6RM via the WGDXC reports on the activity in Nyasaland at present: ZD6RM, c.w. and a.m.; ZD6FC, c.w. and a.m.; ZD6PR, a.m. and s.s.b.; ZD6GA, a.m. and s.s.b.; ZD6HK, newly licensed and using ZD6GA's rig on s.s.b.; ZD6HN and ZD6HJ not active; ZD6DT in QRT in ZE-land; ZD6JC is in VQ2-land; ZD6JL is now ZE1AA.

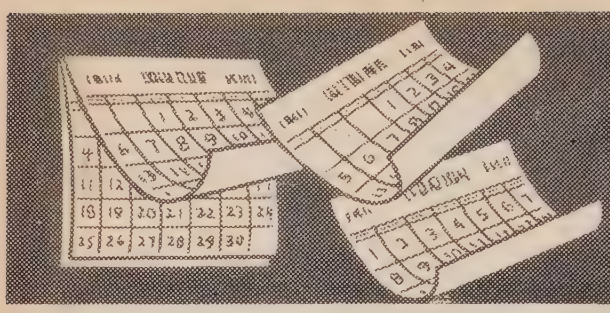
ZD8 Ascencion Island: John Packer is running 20 watts to a piece of wire on a bamboo pole. He generally schedules St. Helena on Thursdays and stays on the air afterwards for other QSO's. Most other evenings he is not able to get on the air. Frequencies reported to date have been 14022 and 14062 kc. IRC's are no good at ZD8. (Tnx WGDXC)

ZK2 Niue: ZK2AD has skeds with W9GFF, his QSL Manager, Tuesdays at 0300 GMT on 14021 kc. (Tnx Florida DX Report)

QTHs

HV1CN	All QSLs for the 1961 *CQ* DX Contest via the Hallicrafters Co.
JZØHW	Via W6DLN
KA2AB	Vernon J. Smith, 2875th GEEIA Sq. Box 154, APO 323, San Francisco, Calif.
KC6BD	QSL c/o U. S. Weather Bureau, Truk, Eastern Caroline Is., South Pacific
KH6EGO/KJ6	517 Laugley Loop, APO 915, San Francisco, Calif.
OA8D	Aldon H. Lane, Box 154, Iqutos, Loreto, Peru
SVØWI/R	Via APO 223, N. Y., N. Y.
SVØWH	6930th RGM/APO 291, N. Y., N. Y.
SVØWO	" " " " " "
SVØWZ	" " " " " "
TL8AC	Via W8KML
UH8BI	Box 93, Ashkhabad, Turkoman, SFSR
VP8EG	Via G8KS
VQ8BC	Arthur Howell, R.N., Wireless Telegraph Stn., Vacoas, Mauritius
XT2Z	Via K4TWF
ex XW8AH	Via 3V8CA
ZD1CM	Via W3KVQ
ZD1S	Via K8MTI
3V8CA	S.S. Wagoner, Jr., USOM Tunisia, c/o U.S. Embassy, Tunis, Tunisia
5R8AA	Marcel Pettitjean, POB 19, Fianarantsoa, Madagascar

[*Continued on page 95*]



CONTEST CALENDAR

FRANK ANZALONE, W1WY
14 Sherwood Road, Stamford, Conn.

CALENDAR OF EVENTS

February	2- 4	ARRL DX Phone
February	9-11	QCWA QSO Party
February	16-18	ARRL DX C.W.
February	24-25	*CQ* WW 160 C.W.
February	24-25	REF C.W.
February	24-26	YL-OM Phone
March	2- 4	ARRL DX Phone
March	10-11	B E R U
March	10-12	YL-OM C.W.
March	16-18	ARRL DX C.W.
March	24-25	*CQ* WW DX SSB
April	7- 8	PZK C.W.
April	14-15	REF Phone
April	14-15	PZK Phone
*April	14-15	Helvetia 22
April	21-22	*CQ* WW VHF
April	28-29	PACC C.W.
May	5- 6	PACC Phone
*May	5- 6	USSR DX
June	1- 4	CHC/HTH QSO Party

* Denotes contests that have not been officially announced.

ARRL DX

Phone: February 2-4 and March 2-4.
C.W.: February 16-18 and March 16-18.
Starting time is 2400 GMT Friday and ending 2400 GMT Sunday on each weekend.

This is the 28th year the ARRL has run this International DX competition, which should just about qualify it as the oldest DX Contest in existence. "Q-Street" gave all the details in last month's issue but the following few pointers will give the uninitiated an idea what its all about.

1. Phone and C.W. are separate contests.

2. Its the world working the USA and Canada. KH6 and KL7 being considered as USA not DX.

3. USA and Canadian stations will send RS and RST reports plus their state or province as their serial numbers. Foreign stations will send RS and RST reports plus a three digit number indicating the power input being used. (ie; 050 representing 50 watts.)

4. Each QSO counts 3 points and a station can be worked once on each band.

5. The multiplier is determined by the number of countries worked on each band, for our side. DX stations will figure theirs by the number of call areas (not states) worked on each band, a maximum of 21 on each band.

6. There is a quota during the c.w. section only of 6 stations per country for W/K stations and 8 per country for the VE/VO boys.

Free log forms are available from the ARRL and your final report of course goes to West Hartford, Conn.

QCWA Party

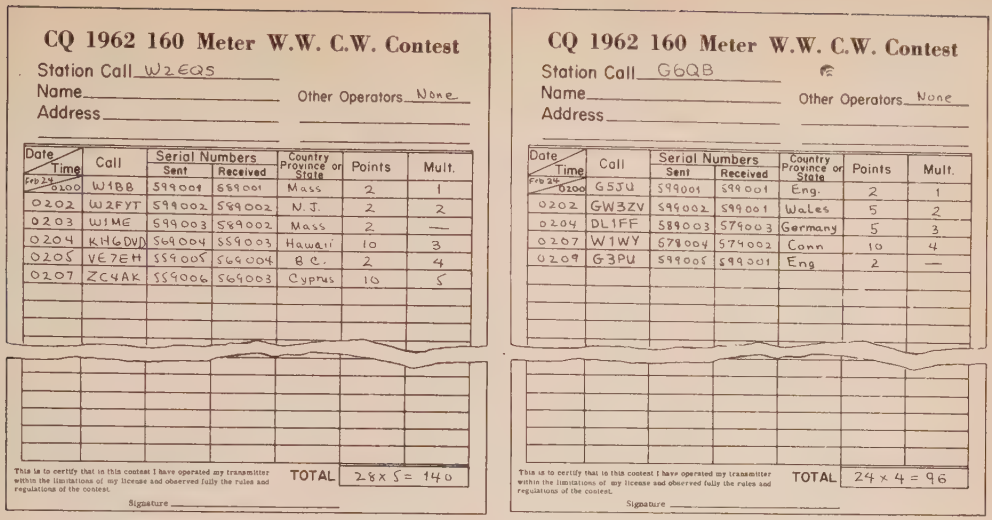
Starts: 2300 GMT Friday, February 9th.
Ends: 2300 GMT Sunday, February 11th.

This is the Fifth Annual QSO Party sponsored by the Quarter Century Wireless Association.

No point scoring or multiplier is involved, just see how many fellow members you can work. Everything goes c.w. a.m., s.s.b. and even RTTY.

Non-members can also contact QCWA stations for the QCWA awards put out by K6BX. (see photo) However only contacts between members will count toward the QCWA Plaque donated by the National Headquarters.

W2ZM, first to work 100 QCWA members, received this certificate primarily through his efforts in last years QCWA party.



CQ 1962 160 Meter W.W. C.W. Contest

Station Call W2EQS
Name
Address
Other Operators None

Date/Time	Call	Serial Numbers Sent	Serial Numbers Received	Country Province or State	Points	Mult.
Feb 24 0200	W1BB	599001	589001	Mass	2	1
0202	W2FYT	599002	589002	N.J.	2	2
0203	W1ME	599003	589002	Mass	2	—
0204	KH6DVD	569004	559003	Hawaii	10	3
0205	VE7EH	559005	569004	B.C.	2	4
0207	ZC4AK	559006	569003	Cyprus	10	5

This is to certify that in this contest I have operated my transmitter within the limitations of my license and observed fully the rules and regulations of the contest.

TOTAL 28 x 5 = 140

Signature

CQ 1962 160 Meter W.W. C.W. Contest

Station Call G6QB
Name
Address
Other Operators None

Date/Time	Call	Serial Numbers Sent	Serial Numbers Received	Country Province or State	Points	Mult.
Feb 24 0200	G5JU	599001	599001	Eng.	2	1
0202	GW3ZV	599002	599001	Wales	5	2
0204	DL1FF	589003	579003	Germany	5	3
0207	W1WY	579004	579002	Conn	10	4
0209	G3PU	599005	599001	Eng	2	—

This is to certify that in this contest I have operated my transmitter within the limitations of my license and observed fully the rules and regulations of the contest.

TOTAL 24 x 4 = 96

Signature

Sample logs for the 1962 WW 160 meter contest: W/VE (left) and KH6 and DX (right).

Your log should show in this order: Contact number, date & time in GMT, station worked, location, band used, his name and his QCWA number.

For more details check last month's CALENDAR.

Two locations to send your logs; for members located east of the Mississippi its: Stearns Poor, W1PO, 128 Mill Street, Hanover, Mass. If you're on the west side of Ole' Miss. send your log to Edward Washburn, W2RG, 6748 Rogers Ave., Mechantville, N.J.

CQ WW 160

Starts: 0200 GMT Saturday, Feb. 24th.
Ends: 1400 GMT Sunday, Feb. 25th.

The Third Annual *CQ* 160 C.W. contest has now been made a World Wide affair. Its going to be quite interesting to see what kind of Top Band activity we have in other countries. We know that the Top Band is well populated in Great Britain and this will probably make working DX more difficult.

For W/VE stations, each contact within these two areas is worth 2 points. However all contacts with stations outside these two countries are worth 10 points. (KH6 is considered a 10 pointer.)

All other countries will claim 2 points for contacts within their own country, 5 points per contact with other countries, except W/VE contacts which are good for 10 points.

The multiplier is derived from the number of States, Canadian provinces and foreign countries worked.

Other details will be found in last month's CALENDAR.

A few pointers if you are new to the Top Band. Look for foreign stations just outside the high end of the 1800-1825 kc segment used by the east coast stations. West coast stations of course occupy the 1975-2000 kc section and will have to be worked cross-band from the east coast.

Remember also, there are regulations regarding power, and some States and many foreign countries are not allowed to use 160. See chart below.

Area	Authorized Bands, Kc	D.C. Plate Input Power in Watts	
		Day	Night
Minnesota, Iowa, Wisconsin, Michigan, Pennsylvania, Maryland, Delaware, and states to the north of these including the District of Columbia	1800-1825	500	200
North Dakota, South Dakota, Nebraska, Colorado, New Mexico, and states to the west of these states (except State of Washington)	1975-2000	500	200
State of Washington	1975-2000	200	50
Oklahoma, Kansas, Missouri, Arkansas, Illinois, Indiana, Kentucky, Tennessee, Ohio, West Virginia, Virginia, North Carolina, South Carolina, Texas (West of 99°W or North of 32°N)	1800-1825	200	50
Hawaiian Islands	1975-2000	500	200
Texas (East of 99°W and South of 32°N), Louisiana Mississippi, Alabama, Georgia, Florida, Puerto Rico, Virgin Islands, Alaska, Guam and other Territories and Possessions of the U.S. not listed above.	None	No Operation	No Operation

YL/OM

Phone

Starts: 1800 GMT Saturday, Feb. 25th.
Ends: 0500 GMT Monday, Feb. 26th.

C.W.

Starts: 1800 GMT Saturday, March 10th.
Ends: 0500 GMT Monday, March 12th.

This is the 13th year in which the YLs see how many OMs they can work over a contest week-end.

Besides the usual certificate awards, there are two Cups on each week-end for the highest scores on phone and c.w.

Check Louisa Sando, W5RZJ's YL Column for the details.

Logs go to: Lillian C. Byrne, K2JYZ, 24 Stillwell Place, Freeport, L.I., N.Y.

REF

C.W.

Starts: 1400 GMT Saturday, February 24th.
Ends: 2200 GMT Sunday, February 25th.

Phone

Starts: 1400 GMT Saturday, April 14th.
Ends: 2200 GMT Sunday, April 15th.

1. The usual serial numbers, RST or RS plus a progressive 3 digit QSO number. In addition, the French stations generally include their location for multiplier identification.

2. Three points for each contact.

3. A multiplier of one for each French department or DUF country worked on each band (excluding F & FC).

4. Final score: Total points multiplied by the total multiplier on all bands.

In addition to contest credit your log can also be used as a reference for the many French awards: DUF, DPF, DDFM etc. Just make your request, with sufficient IRCs to cover postage, to the Awards Manager.

Both your contest logs nd awards applications go to: REF, BP 42 01, Paris R P, France.

B.E.R.U.

This is a contest open only to countries that are members of the British Empire. Some real juicy prefixes always seem to show up during this contest, but don't go calling them if you are not eligible. You might end up on the "black list" and receive no attention at a later date.

CQ WW SSB

Starts: 1200 GMT Saturday, March 24th.
Ends: 1800 GMT Sunday, March 25th.

With the deteriorating band conditions it was decided to hold this contest at a later date than previous years. Hope we made a wise decision.

There are also some rule changes, and don't forget you're only permitted to work 24 hours out of the 30 hour contest period.

Better check Dorothy's and Irv's SSB Column for January.

The Tusco Radio Club of Ohio has a thing going the first two weekends of this month. If you're a 10 meter phone man, a.m. or s.s.b., and happen to work some W8s on the above dates, its a 50-50 chance that you worked a member of the "Knucklehead Net." Five or more contacts will make you eligible for an award.

Send a list of your contacts to the Tusco Radio Club, 309 S. Tuscarawas Ave., Dover, Ohio.

We still await official information from the Helvetia 22 and USSR DX contests.

The PZK of Poland has come up with a new one in April and same will be covered in next month's CALENDAR.

Had the pleasure of a nice long chat with Ted Truskowski, OD5LX, during his Stateside visit the later part of November. We have always relied on Ted putting Lebanon on the contest map during the past, but he didn't get back in time for this last one. However he went back with a lot of new equipment so look for some OD activity on s.s.b. and possibly 160 this coming season.

And speaking of contests, how about those crazy conditions during our c.w. week-end. Boy! was that a pleasant surprise. George Jacobs tried to explain what happened to me. Something about the predicted disturbance being there but it worked to our advantage, instead of the expected "blackout." You had better let George explain it to you in his Column.

[*Continued on page 102*]

CLAIMED SCORES

1961 CQ WW C.W. DX Contest

Single Operator

All Band

KW6DG	860,175
KH6IJ	791,840
W4KFC	645,663
W3GRF	622,506
HC1AGI	460,782
W2BXA	362,799
W4KXV	326,435
K2DCA	277,632
W5WZQ	266,500
HB9NL	253,736
W3EIV	221,343
HB9EU	178,450

28 Mc

K2HWL	7,130

21 Mc

W2WZ	77,910
W5LGG	66,444
W1WY	60,734
W3LSG	59,925
W4JAT	42,688
W1OJR	33,915
W9GIL	31,950
W8TTN	23,857
HB9DX	14,344

14 Mc

KA2JL	194,098
HK1AAF	150,728
W1BIH	142,374
W3JTC	117,652
UC2AA	107,448
W1GYE	87,840
DL4DZ	67,680
VE2NV	57,120
KZ5LC	54,038
ZL4LB	44,400
LA6VC	42,750
EP2AF	40,584
W8SA	36,860
HM4AQ	20,645

7 Mc

K2DGT	132,973
VK3ADB	78,588
JA8FC	26,164
W9HUZ	24,948

3.5 Mc

W1BU	5,104
W6FOZ	4,716
K4LGI	3,700
W4SHJ	1,650
W4WHK	1,500
W8KIA	897

Multi-Operator

Single Xmtr

W2JT	527,000
W9YT	208,302
W8NGO	76,960

Multi-Xmtr.

W3MSK	1,411,144

PROPAGATION

George Jacobs, W3ASK
11307 Clara St., Silver Spring, Md.

LAST MINUTE FORECAST

The following is a forecast of day-to-day propagation conditions expected during February, 1962. This forecast attempts to predict the *specific* days upon which openings shown in the Propagation Charts in this column are most likely to occur, and the expected quality of the openings. For example, the following forecast shows that circuits rated (2) in the Charts are most likely to open with "good" quality, (B) when conditions are "above normal" (February 18-19), and with "fair to poor" quality (C-D) on days when conditions are expected to be normal. Circuits rated (2) are not expected to open on these days forecast to be "below normal" or "disturbed", etc.

PROPAGATION CONDITIONS and CIRCUIT QUALITY

Prop. Chart Forecast Rating	*Above Normal* Feb. 18-19	*Normal* Feb. 1-6, 10-17, 20, 28	*Below Normal* Feb. 7-9, 21, 25-27	*Disturbed* Feb. 22-24
(1)	C	D-E	E	E
(2)	B	C-D	E	E
(3)	A	B-C	D-E	E
(4)	A	A-B	C	D-E

Where:

A—Excellent opening with strong steady signals.

B—Good opening, moderately strong signals, with some fading and noise.

C—Fair opening, signals fluctuating between moderately strong and weak, with moderate fading and noise.

D—Poor opening, signals generally weak, with considerable fading and high noise level.

E—Very poor opening, or none at all.

VERY little is forecast for 10 meters this month, except for some fairly regular daytime openings to South America, and some from the West Coast to Australasia. Fewer 15 meter openings are predicted for February, but the band is expected to remain open to many areas of the world from shortly after sunrise through the early evening hours. Twenty meters is likely to be the best band for DX during the daytime hours. The band is expected to open at sunrise, and remain open until a few hours after sunset. When propagation conditions are better than normal, 20 meters may remain open to some areas of the world through the evening hours.

Good DX propogation conditions are expected to continue on 40 meters from sunset, through the hours of darkness, until shortly after sunrise. The band is expected to open to many areas of the world, and during many openings signal levels may be exceptionally strong. Fairly good nighttime openings to some parts of the world are also forecast for 80 meters, and even the 160 meter band should open for DX during the hours of darkness. Special 160 meters Transatlantic DX tests are scheduled for February 4 and 18, from 0500-0730 GMT (12 Midnight-2:30 A.M., EST).

This month's Propagation Charts contain predictions for major DX paths for February and March. For a short-skip propagation forecast for February, see the Charts appearing in last month's column. A "Last Minute Forecast", showing day-to-day conditions expected during February, appears at the beginning of this column.

Beginning with the DX Propagation Charts appearing this month, a change in format has been made which will permit more detailed forecasts to be made for the bands that will be most useful during the coming period of low sunspot activity. Ten and 15 meter openings will now be shown in the same column, with 10 meter openings identified with an asterisk (*). Separate columns will be used for the 20 and 40 meter forecasts, since these bands are expected to be optimum for DX during the next few years. Predictions of 80 and 160 meter openings will share a column, with 160 meter openings shown with a double asterisk (**). This will allow more detailed forecasts to be made for both these bands, which are expected to open more frequently for DX as the sunspot numbers decrease.

Starting about the middle of February, and continuing through the early spring months, a noticeable improvement usually takes place in high frequency propagation conditions between the northern and southern hemispheres. This improvement is expected to be most noticeable on paths from the United States to South Africa, Australasia, and the southern areas of South America. The improvement should be noticeable on all bands, 10 through 160 meters.

Auroral displays generally occur more often during February and the early spring than during the winter months. Coincident with these displays, there is a tendency for severe and prolonged ionospheric disturbances, or radio storms, to take place. While DX openings on the high frequency bands may become poor, or non-existent, during such storms, unusual short-

Time Zone: EST

EASTERN USA TO:

	10*/15 Meters	20 Meters	40 Meters	80/160** Meters
Western & Central Europe	10A - 1 P (1)* 8 A - 10A(1) 10A - 12N(2) 12N - 2 P (3) 2 P - 4 P (1)	6 A - 7 A (1) 7 A - 9 A (2) 9 A - 12N (1) 12N - 2 P (2) 2 P - 3 P (4) 3 P - 4 P (3) 4 P - 5 P (2) 5 P - 8 P (1)	4 P - 6 P (1) 6 P - 7 P (2) 7 P - 11P (4) 11P - 2 A (2) 2 A - 5 A (1)	6 P - 8 P (1) 8 P - 11P (3) 11P - 1 A (1) 8 P - 9 P (1)** 9 P - 12M(2)** 12M- 1 A (1)**
Eastern Europe & Eastern USSR	9 A - 1 P (1)	7 A - 12N (1) 12N - 2 P (2) 2 P - 4 P (1)	7 P - 2 A (1)	8 P - 12M (1) 9 P - 11P (1)**
Southern Europe & North Africa	10A - 2 P (1)* 7 A - 9 A(1) 9 A - 11A(2) 11A - 1 P (3) 1 P - 2 P (2) 2 P - 5 P (1)	6 A - 12N (1) 12N - 3 P (2) 3 P - 4 P (4) 4 P - 5 P (3) 5 P - 6 P (2) 6 P - 9 P (1)	5 P - 6 P (1) 6 P - 7 P (2) 7 P - 12M(4) 12M- 1 A(2) 1 A - 3 A(1)	7 P - 9 P (1) 9 P - 11P (2) 11P - 1 A(1) 8 P - 12M(1)**
South Africa	10A - 1 P (1)* 7 A - 11A(1) 11A - 2 P (2) 2 P - 5 P (1)	2 P - 4 P (1) 4 P - 6 P (3) 6 P - 7 P (2) 7 P - 9 P (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 11P (1)	7 P - 10P (1) 7 P - 9 P (1)**
Eastern Mediterranean	9 A - 1 P (1)	10A - 2 P (1) 2 P - 4 P (2) 4 P - 7 P (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 11P (1)	7 P - 11P (1) 8 P - 10P (1)**
Central Asia	9 A - 12N (1)	7 A - 9 A (1) 12N - 3 P (1)	6 P - 9 P (1) 5 A - 7 A(1)	NIL
Southeast Asia	12N - 4 P (1)	7 A - 9 A (2) 9 A - 11A (1) 5 P - 9 P (1)	6 A - 8 A (1)	NIL
Far East	4 P - 7 P (1)	7 A - 9 A (1) 4 P - 5 P (1) 5 P - 7 P (2) 7 P - 9 P (1)	5 A - 8 A (1)	6 A - 7 A (1)
Pacific Islands & New Zealand	1 P - 6 P (1)* 12N - 5 P (1) 5 P - 7 P (2) 7 P - 9 P (1)	7 P - 9 P (1) 9 P - 12M(2) 12M- 7 A(1) 7 A - 9 A(3) 9 A - 10A(2) 10A - 1 P (1)	12M - 2 A (1) 2 A - 6 A (3) 6 A - 8 A (1)	2 A - 3 A (1) 3 A - 5 A (2) 5 A - 7 A (1) 2 A - 6 A (1)**
Australia	4 P - 7 P (1)* 9 A - 11A(1) 4 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	6 A - 7 A (1) 7 A - 9 A (3) 9 A - 10A (2) 10A - 1 P (1) 8 P - 12M (1)	4 A - 5 A (1) 5 A - 7 A (2) 7 A - 9 A (1)	5 A - 7 A (1) 5 A - 7 A (1)**
South America	7 A - 2 P (1)* 2 P - 4 P (2)* 4 P - 6 P (1)* 6 A - 7 A(1) 7 A - 10A(3) 10A - 2 P (2) 2 P - 5 P (4) 5 P - 7 P (2) 7 P - 9 P (1)	2 P - 4 P (1) 4 P - 6 P (2) 6 P - 8 P (4) 8 P - 10P (3) 10P - 12M(2) 12M- 6 A(1) 6 A - 8 A(2) 8 A - 10A(1)	6 P - 7 P (1) 7 P - 8 P (2) 8 P - 3 A(3) 3 A - 5 A(2) 5 A - 6 A(1)	7 P - 9 P (1) 9 P - 3 A(2) 3 A - 4 A(1) 9 P - 3 A(1)**
McMurdo Sound, Antarctica	3 P - 5 P (1) 5 P - 7 P (2) 7 P - 9 P (1)	5 P - 7 P (1) 7 P - 10P (2) 10P - 12M(1)	11P - 6 A (1)	NIL

Time Zones: CST & MST

CENTRAL USA TO:

	10*/15 Meters	20 Meters	40 Meters	80/160** Meters
Western & Central Europe	8 A - 10A (1) 10A - 1 P (2) 1 P - 2 P (1)	7 A - 11A (1) 11A - 3 P (2) 3 P - 6 P (1)	5 P - 7 P (1) 7 P - 10P (2) 10P - 2 A(1)	8 P - 11P (1) 8 P - 10P (1)**
Eastern Europe & European USSR	8 A - 1 P (1)	7 A - 2 P (1)	7 P - 1 A (1)	8 P - 11P (1)
Southern Europe & North Africa	10A - 1 P (1)* 8 A - 10A(1) 10A - 1 P (2) 1 P - 3 P (1)	6 A - 12N (1) 12N - 2 P (2) 2 P - 4 P (3) 4 P - 5 P (2) 5 P - 7 P (1)	5 P - 7 P (1) 7 P - 8 P (2) 8 P - 10P (3) 10P - 11P (2) 11P - 1 A(1)	7 P - 8 P (1) 8 P - 10P (2) 10P - 11P (1) 8 P - 10P (1)**

Time Zones: CST & MST, Con't.

CENTRAL USA TO

	10*/15 Meters	20 Meters	40 Meters	80/160** Meters
Central Africa	11A - 4 P (1)* 9 A - 11A(1) 11A - 1 P (2) 1 P - 3 P (3) 3 P - 4 P (2) 4 P - 7 P (1)	1 P - 3 P (1) 3 P - 5 P (2) 5 P - 7 P (3) 7 P - 8 P (2) 8 P - 10P (1)	6 P - 8 P (1) 8 P - 10P (2) 10P - 12M(1)	7 P - 10P (1) 7 P - 9 P (1)†
Eastern Mediterranean	9 A - 12N (1)	8 A - 3 P (1)	7 P - 9 P (1)	NIL
Central Asia	8 A - 10A (1)	7 A - 11A (1) 7 P - 9 P (1)	7 P - 9 P (1) 6 A - 8 A(1)	NIL
Southeast Asia	10A - 2 P (1) 5 P - 8 P (1)	7 A - 9 A (2) 9 A - 12N (1) 7 P - 10P (1)	6 A - 8 A (1)	NIL
Far East	4 P - 7 P (1)* 3 P - 4 P (1) 4 P - 5 P (2) 5 P - 7 P (3) 7 P - 8 P (2) 8 P - 3 P (1)	7 A - 11A (1) 4 P - 7 P (1) 7 P - 9 P (2) 9 P - 11P (1)	2 A - 9 A (1)	3 A - 7 A (1)
Pacific Islands	10A - 2 P (1)* 6 P - 8 P (1)* 10A - 11A(1) 11A - 3 P (2) 3 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 11P (3) 11P - 3 A(2) 3 A - 7 A(1) 7 A - 9 A(2) 9 A - 2 P (1)	10P - 1 A (1) 1 A - 6 A (3) 6 A - 7 A (2) 7 A - 8 A (1)	12M - 1 A (1) 1 A - 6 A (2) 6 A - 7 A (1) 1 A - 6 A (1)**
New Zealand	1 P - 5 P (1)* 11A - 1 P (2) 1 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	6 P - 8 P (1) 8 P - 9 P (2) 9 P - 12M(3) 12M- 4 A(2) 4 A - 7 A(1) 7 A - 9 A(2) 9 A - 12N(1)	11P - 1 A (1) 1 A - 6 A (3) 6 A - 7 A (2) 7 A - 8 A (1)	1 A - 2 A (1) 2 A - 6 A (2) 6 A - 7 A (1) 2 A - 6 A (1)**
Australia	2 P - 7 P (1)* 8 A - 10A (1) 2 P - 5 P (1) 5 P - 7 P (2) 7 P - 10P (1)	6 A - 7 A (1) 7 A - 9 A (3) 9 A - 10A (2) 10A - 3 P (1) 9 P - 1 A (1)	3 A - 4 A (1) 4 A - 7 A (2) 7 A - 9 A (1)	5 A - 8 A (1) 5 A - 7 A (1)**
North & Central South America	8 A - 11A (1)* 7 A - 8 A (1) 8 A - 10A (2) 10A - 1 P (1) 1 P - 4 P (3) 4 P - 5 P (2) 5 P - 7 P (1)	6 A - 9 A (1) 2 P - 4 P (1) 4 P - 6 P (2) 6 P - 9 P (4) 9 P - 11P (3) 11P - 2 A (2) 2 A - 3 A (1)	6 P - 8 P (1) 8 P - 2 A(3) 2 A - 3 A(2) 3 A - 5 A(1)	8 P - 9 P (1) 9 P - 2 A(2) 2 A - 4 A(1) 9 P - 3 A(1)**
Argentina, Chile & Uruguay	9 A - 1 P (1)* 1 P - 4 P (2)* 4 P - 6 P (1)* 7 A - 10A (2) 10A - 1 P (1) 1 P - 3 P (2) 3 P - 6 P (4) 6 P - 7 P (2) 7 P - 9 P (1)	6 A - 9 A (1) 2 P - 4 P (1) 4 P - 6 P (2) 6 P - 9 P (4) 9 P - 1 A (2) 1 A - 3 A (1)	7 P - 9 P (1) 9 P - 3 A(3) 3 A - 4 A(2) 4 A - 5 A(1)	9 P - 10P (1) 10P - 2 A(2) 2 A - 4 A(1) 10P - 2 A(1)**
McMurdo Sound, Antarctica	1 P - 4 P (1) 4 P - 7 P (2) 7 P - 9 P (1)	9 A - 11A (1) 5 P - 7 P (1) 7 P - 11P (2) 11P - 1 A (1)	12M - 7 A (1)	NIL

Time Zone: PST

WESTERN USA TO:

	10*/15 Meters	20 Meters	40 Meters	80/160** Meters
Western & Central Europe	8 A - 12N (1)	6 A - 8 A (1) 8 A - 11A (2) 11A - 3 P (1)	6 P - 12M (1)	7 P - 10P (1) 7 P - 9 P (1)**
Eastern Europe & European USSR	7 A - 10A (1)	6 A - 7 A (1) 7 A - 9 A (2) 9 A - 12N (1)	7 P - 11P (1)	NIL
Southern Europe & North Africa	8 A - 12N (1)	7 A - 11A (1) 11A - 1 P (2) 1 P - 3 P (1)	6 P - 7 P (1) 7 P - 9 P (2) 9 P - 10P (1)	7 P - 10P (1) 7 P - 9 P (1)**
South Africa	8 A - 11A (1)* 6 A - 10A (1) 10A - 12N (2) 12N - 2 P (1)	5 A - 7 A (1) 11A - 1 P (1) 1 P - 4 P (2) 4 P - 6 P (1) 9 P - 11P (1)	7 P - 10P (1)	8 P - 9 P (1)

Time Zone: PST, Con't.

WESTERN USA TO:

	10*/15 Meters	20 Meters	40 Meters	80/160** Meters
Eastern Mediterranean	8 A - 11A (1)	7 A - 12N (1) 7 P - 9 P (1)	6 P - 9 P (1)	NIL
Central Asia	5 P - 7 P (1)	7 A - 11A (1) 5 P - 9 P (1)	5 A - 8 A (1)	NIL
Southeast Asia	4 P - 6 P (1)* 9 A - 10A (1) 10A - 11A (2) 11A - 12N (1) 4 P - 6 P (2) 6 P - 8 P (1)	8 A - 9 A (1) 9 A - 11A (2) 11A - 1 P (1) 7 P - 11P (1)	3 A - 6 A (2) 6 A - 8 A (1)	4 A - 7 A (1) 4 A - 6 A (1)**
Far East	3 P - 6 P (1)* 1 P - 2 P (1) 2 P - 4 P (2) 4 P - 6 P (3) 6 P - 7 P (2) 7 P - 8 P (1)	7 A - 9 A (1) 1 P - 6 P (1) 6 P - 7 P (2) 7 P - 9 P (3) 9 P - 10P (2) 10P - 11P (1)	12M - 2 A (1) 2 A - 6 A (3) 6 A - 8 A (2) 8 A - 9 A (1)	2 A - 3 A (1) 3 A - 5 A (2) 5 A - 7 A (1) 3 A - 6 A (1)**
Pacific Islands	10A - 12N (1)* 6 P - 9 P (1)* 9 A - 12N (2) 12N - 4 P (1) 4 P - 6 P (2) 6 P - 8 P (3) 8 P - 9 P (2) 9 P - 10P (1)	7 A - 8 A (1) 8 A - 10A (2) 10A - 5 P (1) 5 P - 8 P (2) 8 P - 10P (4) 10P - 11P (3) 11P - 1 A (2) 1 A - 3 A (1)	9 P - 10P (1) 10P - 5 A (3) 5 A - 7 A (2) 7 A - 8 A (1)	10P - 11P (1) 11P - 5 A (2) 5 A - 7 A (1) 11P - 5 A (1)**
Australia	2 P - 6 P (1)* 12N - 5 P (1) 5 P - 8 P (2) 8 P - 10P (1)	7 A - 8 A (1) 8 A - 10A (2) 10A - 12N (1) 8 P - 10P (1) 10P - 12M (2) 12M - 3 A (1)	1 A - 3 A (1) 3 A - 5 A (3) 5 A - 7 A (2) 7 A - 8 A (1)	2 A - 3 A (1) 3 A - 5 A (2) 5 A - 7 A (1) 4 A - 6 A (1)**
New Zealand	11A - 1 P (1)* 1 P - 4 P (2)* 4 P - 6 P (1)* 9 A - 10A (1) 10A - 12N (3) 12N - 6 P (2) 6 P - 8 P (4) 8 P - 9 P (2) 9 P - 10P (1)	8 A - 9 A (1) 9 A - 10A (2) 10A - 1 P (1) 7 P - 8 P (1) 8 P - 10P (4) 10P - 12M (3) 12M - 2 A (2) 2 A - 4 A (1)	9 P - 10P (1) 10P - 11P (2) 11P - 5 A (3) 5 A - 6 A (2) 6 A - 7 A (1)	10P - 11P (1) 11P - 5 A (2) 5 A - 6 A (1) 12M - 4 A (1)**
North & Central South America	7 A - 12N (1)* 6 A - 12N (1) 12N - 2 P (2) 2 P - 6 P (1)	1 P - 3 P (1) 3 P - 5 P (2) 5 P - 7 P (4) 7 P - 8 P (3) 8 P - 9 P (2) 9 P - 2 A (1) 4 A - 7 A (1)	6 P - 8 P (1) 8 P - 12M(3) 12M - 2 A(2) 2 A - 3 A(1)	7 P - 8 P (1) 8 P - 12M(2) 12M - 2 A (1) 8 P - 1 A (1)**
Argentina, Chile & Uruguay	8 A - 12N (1)* 12N - 3 P (2)* 3 P - 4 P (1)* 6 A - 7 A (1) 7 A - 9 A (2) 9 A - 11A (1) 11A - 2 P (2) 2 P - 4 P (4) 4 P - 6 P (2) 6 P - 7 P (1)	1 P - 3 P (1) 3 P - 5 P (2) 5 P - 7 P (4) 7 P - 9 P (3) 9 P - 12M(2) 12M- 8 A (1)	6 P - 8 P (1) 8 P - 1 A(3) 1 A - 2 A(2) 2 A - 3 A(1)	7 P - 8 P (1) 8 P - 1 A (2) 1 A - 3 A (1) 8 P - 1 A (1)**
McMurdo Sound Antarctica	12N - 3 P (1) 3 P - 6 P (2) 6 P - 8 P (1)	9 A - 11A (1) 4 P - 7 P (1) 7 P - 10P (2) 10P - 2 A (1)	12M - 6 A (1)	NIL

FORECAST RATINGS

The Numerical ratings appearing in parenthesis following each predicted time of band opening indicate the total number of days during each month of the forecast period that the opening is expected to occur, as follows:

(1) Less than 7 days
(2) Between 8 and 13 days
(3) Between 14 and 22 days
(4) More than 22 days

For the specific days of each month on which a particular opening is most likely to occur, as well as a day-to-day forecast of reception quality (signal, noise and fading levels), see the "Last Minute Forecast" which appears elsewhere in the column.

* Indicates predicted 10 meter openings
** Indicates predicted 160 meter openings

A - A.M. P - P. M. N - Noon M - Midnight

The CQ DX Propagation Charts are based upon a CW effective radiated power of 150 watts at radiation angles lower than thirty degrees. The Eastern USA Chart can be used in the 1, 2, 3, 4 and 8 call districts; the Central USA Chart in the 5, 9 and 0 districts, and the Western USA Chart in the 6 and 7 districts. The Charts are valid through March 31, 1962. Propagation forecasts contained in these Charts are derived from basic ionospheric data published by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

skip openings for distances up to approximately 1300 miles may be possible on 10 meters and the v.h.f. bands as a result of ionization associated with the aurora.

Sunspot Cycle

The sunspot cycle continues to decline at a relatively rapid rate. The Zurich Solar Observatory reports a monthly sunspot number of 30 for November 1961. This is the lowest level of monthly sunspot activity recorded since July 1955. The drop in solar activity during November reduces the latest 12-month running smoothed sunspot number, which is centered on May 1961, to 59. A smoothed sunspot number of 42 is predicted for February 1962.

DX Contest Post Mortem

Despite the forecast for "generally normal shortwave propagation conditions" made in this column for the Phone Section of the *CQ* DX Contest, a moderate to severe radio storm did develop which marred reception during a good part of this period. Conditions were more or less normal when the Contest began at 0200 GMT, October 28. Several good openings were reported on 40 meters during the early hours of the Contest, but at 0810 GMT (according to CRPL records) a sudden magnetic storm began. Shortly thereafter, the ionosphere became disturbed and propagation conditions began to deteriorate. Conditions remained poor-to-fair throughout most of the daylight hours of the 28th, with Transatlantic MUFs barely reaching 21 mc. By 1800 GMT, the full fury of the storm hit, and the ionosphere became severely disturbed. What few signals were propagated by the badly diffused ionosphere, were distorted by severe flutter fading. By 2300 GMT, October 28, an almost complete blackout of shortwave reception began in the northern hemisphere, and propagation conditions remained very poor until about 1000 GMT, October 29. With the return of daylight, the storm subsided considerably, and the ionosphere began to return slowly to normal. Although Transatlantic MUFs barely reached 21 mc for the second day in a row, conditions remained fair or better throughout the remainder of the 29th, and until the Contest ended at 0200 GMT, October 30.

As a result of the unpredicted storm, there were practically no 10 meter openings from the United States, and only few 15 meter openings. Although 20 meters did open to some areas of the world, the openings were generally of poor quality and of short duration. While propagation conditions were fairly good on both 40 and 80 meters at the beginning and at the end of the Contest period, the blackout on the evening of October 28-29 prevented many points from being accumulated on these bands. That scores will be exceptionally low for the 1961 Phone Section of the *CQ* DX Contest, is already evident from the initial tabulations submitted to W1WY, *CQ*'s Contest Editor.

[*Continued on page 102*]

sideband sideband sideband

SIDEBAND

IRV and DOROTHY STRAUBER,
K2HEA/K2MGE
12 ELM STREET, LYNBROOK, NEW YORK

CQ SSB Stickers and Certificates

Worked 200
W2LV W2TP

Worked 175
W2NUT W5RHW
W2TP

Worked 150
W1AOL WA6HOH
K2CJN OE1RZ

Worked 125
K1IDW WØKFA
K2CJN
OE1RZ ZL3AB

Worked 100
K2CJN WØKFA
W4SSU G3WW
K9HOL GM3JDR

Worked 75
K2CJN UB5UG
JA2JW

Worked 50
K2CJN

MOBILEERS soon learn one of the "black bread" type facts of life . . . you can't get a signal out of a tunnel. So, when in one of those traps with a fellow mobileer in front or behind, uncomplimentary remarks could be exchanged without fear of doing damage to any of the FCC's injunctures, specifically the one about the use of obscene or suggestive language.

Seems that the word "tunnel" has been extended to electronics with the "tunnel diode" and now has been given further extension with round table type "tunnels" on the ham bands. Taking advantage of closed in bands during the evening hours, some of the boys, and they are just that, have been giving free reign to their conversation and turning the air blue with conversational gambits that violate the spirit, the letter and the sensibilities of the rest of the hams in the area.

We're not going to drag out the soap box on this occasion; the number of practitioners of the "tunnelling" are small; we'd hate to see it grow. Remember, someone is always listening; he might blow the whistle, and you, your license!

K5DGI Tops WAS SSB Contest

Wes Attaway, K5DGI, of Shreveport, Louisiana, was top scorer in the SSBARA WAS SSB Contest which took place on Sept. 9-10, 1961. In a very close race with Dick, K6CTV, Wes logged 23 more contacts to head the list of contestants. Both Wes and Dick, of course, worked all 50 states which was the main object of this contest. Other successful week-end WAS sidebanders were Dana, W1HKK, top SSBARA member winner; Rick, K5USE; Dick, W5BVI; Dave, K5MDX; Al, K6RIM; Bill, K9MFH; George, KØRDP; and John, KØLUX. Interestingly enough, no one in the 2nd, 3rd, 4th, or 7th Districts worked all 50 states although Eloy, W1DBN/4, and Joyce, KØIKL, fell short by just one. In fact, although we hate to admit it, the one state Eloy needed was Delaware. He claims that he called us many times as we were mobiling through that rare state but we just didn't hear him. Honest, Eloy!

Once again the contest weekend conflicted with the arrival of another hurricane, this time Carla. We're happy to report that we heard no adverse comments about contestants interfering with the passing of emergency traffic which, once again, was so magnificently handled by our sidebanders.

As Grand Champion, Wes will receive a lifetime membership in the SSBARA and a suitably engraved trophy. (This ought to make up for the $15 fine levied on him by his fraternity brothers because he missed a "rush" weekend at Louisiana State University). Dana, W1HKK, will also receive a trophy which will be presented to him at the 11th Annual Sideband Hamfest-Banquet on March 27, 1962 in New York City.

Certificates are being designed and will be sent as soon as available to the top operators in each state while special prizes will be forwarded to each of those contestants working all 50 states.

Far too few contestants submitted their logs. However, here is the listing of those who did so:

The following are the results of the *CQ* S.S.B. WAS contest. Number groups following each call are: total contacts, total states and point total.

W1HKK*†	336	50	16,800
W1WY	69	33	2,277
W1PLJ	24	13	312
W1JJL	15	9	135
WA2WBH†	336	46	15,456
W2JQZ	277	45	12,385
K2HWF	105	37	3,885
WA2LIJ	52	24	1,248
W2OWL	52	24	1,248
W2ZWB	35	22	840
K3OWV†	183	44	8,052
W3OCU	141	38	5,358
W4KCG†	300	45	13,500
W1DBN/4	245	49	12,005
W4ICS	197	44	8,468
W4BLX	168	41	6,888
W4DS	58	32	1,856
K5DGI*†	560	50	28,000
K5USE*	345	50	17,250
W5BVI*	297	50	14,850
K5MDX*	281	50	14,050
K5YIB	103	39	4,017
K5FLY	106	30	3,180
K5YQG	80	32	2,560
K5UYF	50	26	1,800
W5UBW	52	18	936
K6CTV*†	537	50	26,850
K6RIM*	223	50	11,150
WA6LYX	120	44	5,280
W6LKE	103	48	4,944
WA6HGE	110	36	3,960
K4LYG/7†	239	47	11,236
K7HDH	182	40	7,280
K7MER	166	41	6,765
W9JDJ/7	57	27	1,539
W7HRM	36	21	756
K7JBQ	35	17	595
W8FAW†	140	45	6,300
K8ELF	90	37	3,330
K9MFH*†	413	50	20,650
K9HOL	315	46	14,490
W9YT	135	35	4,725
K9ICI	98	45	4,410
K9YOD	79	44	3,476
W9CTY	84	34	2,856
W9ROM	46	22	1,012
KØIKL†	373	49	18,277
KØRDP*	337	50	16,850
KØLUX*	172	50	8,600
KØIFL	146	38	5,548
KØJPJ	97	34	3,298
WØKCG	64	31	1,984
KH6IJ†	228	42	9,376
G3PEU	225	32	7,200
KL7DPL†	80	25	2,000
KW6DG	24	11	264

* WAS Prize winners
† WAS Certificate winners

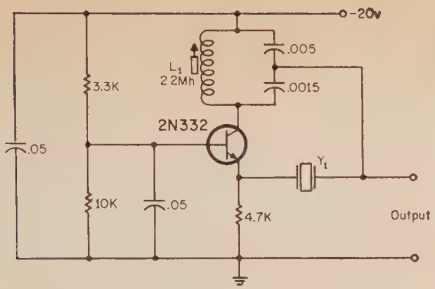


Fig. 1—Schematic of a 100 kc crystal calibrator offering extreme stability. Crystal Y_1 is a James Knights type G9-D 100 kc unit.

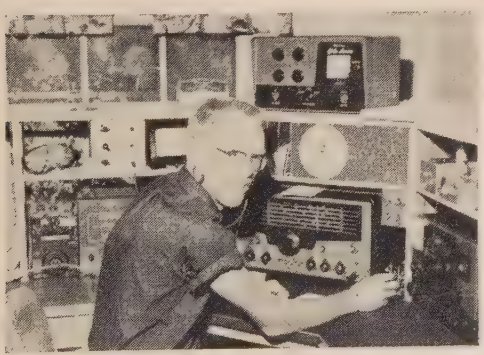
100 kc Crystal Calibrator

Some of our more expensive receivers come equipped with 100 kc marker oscillators built right in; others require the expenditure of varied sums to add their usefulness to the receiver. If you are of a mind to, the James Knights Company has a circuit using a 2N332 transistor, a handful of parts which you probably have in the junk box and a 100 kc crystal. Silver mica capacitors are suggested for stability. Frequency stability is 2×10^{7} for supply voltage variations of plus or minus 10%.

11th Annual Sideband Dinner

The 11th Annual Single Sideband Hamfest-Banquet, which is again being sponsored by the Single Sideband Amateur Radio Association, will take place from 10 AM to midnight on Tuesday, March 27, 1962 at the Statler Hilton Hotel in New York City. Now a firmly entrenched institution, the Sideband Hamfest-Banquet affords sidebanders from all over the country a unique opportunity to meet each other in social conviviality. The very latest in sideband equipment and accessories is displayed and gives operators a fine chance to consider additions to or changes in their stations.

Mike, WA2BLH, is the General Chairman of this year's sideband event. He is being assisted by the following committees: Hotel Arrangements, Irv, W2IVW; Mort, W2KR; Ed, W2KPQ; and Bing W2CMM. Exhibits, Russ, K2RLY; Vince, W2HGP; and Mort, W2KR. Treasurer, Irv, W2IVW. Door Prizes, Ed. W2KPQ; Dorothy, K2MGE; and Vince, W2HGP, Membership, Doris, WA2HTI; and Charlie, WA2GYC. Publicity, Ed, W2KPQ; Dorothy, K2MGE; and Irv, K2HEA. Seating and Tickets, Stan, WA2GFV; Art, W2CYK; Buddy, W2JKN; Jerry, K2QEY; and Larry, W2FGZ.



Wes Attaway, K5DGI of Shreveport, Louisiana, high scorer in the SSBARA WAS SSB Contest. Wes led the Fifth District in last year's SSB DX Contest which is really going some when you realize that he comes home from LSU only for a contest weekend. Congratulations to you, Wes, for some mighty fine operating!

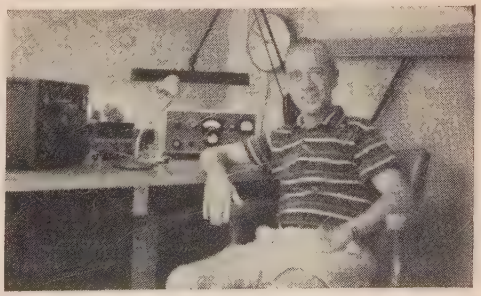
Pee Wee Hunt is a name familiar to millions of us through his enjoyable musicianship with the old Casa Loma band. Here is the man himself (left), K1AYA, now the leader of his own band, and a regular on sideband on the low end of 40 meters. Pee Wee is shown with "Falcon" Taylor, during a visit to "The Lair" at Hammondsport, New York. Don't know what part of his sideband rig "Falcon" is showing Pee Wee but it sure looks like an interesting addition to a ham shack!

Since the annual Sideband Hamfest-Banquet is held during IRE Week in New York, it gives many out-of-town visitors interested in the electronics field a chance to fraternize with their sideband friends. As during last year's highly successful affair, there will again be professional Broadway and Hollywood talent to enliven the Banquet. Bill Leonard, W2SKE, well known TV and radio star and popular ham, will act as Master of Ceremonies.

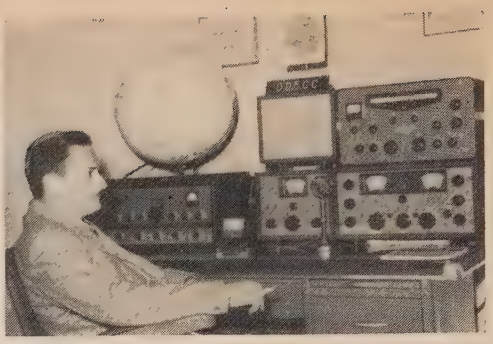
Tickets are available at $10.00 per person with advance registration and it is urged that you make your reservations early by contacting Stan, WA2GFV, 1385 Richmond Court, East Meadow, New York, who will send you full information. See you at the 11th Annual Single Sideband Hamfest-Banquet March 27!

Ready For The Sideband DX Contest

As the Sixth Annual *CQ* Sideband DX Contest draws closer, sidebanders all over the world are checking their rigs and antennas to make sure that all is in readiness for the big weekend. The Contest will take place from 1200 GMT, Saturday, March 24 1962, to 1800 GMT, Sunday, March 25, 1962, with 24 hours of operation permitted. The object of the Contest is to work as many different prefixes and as many differ-



Here's Ray Farwell, W4BJ, of Miami, Florida, back in action again after two operations last summer. Ray has made countless friends in ham radio over the years and we know you'll all be glad to see how chipper he looks. After having worked 260 countries, Ray is feeling his oats and plans to go in for sideband DX in a big way so it looks like the Honor Roll will soon be including a new call, W4BJ. (Photo by Lou Fischman, W2SJL)



Two valuable members of the Lebanese sideband group are Steve, left, OD5CC, and Aref, right, OD5CN, pictured at his operating table during the 1961 CQ Fone Contest. Aref recently spent several months in the States and we hope you had a chance to meet this fine young man.

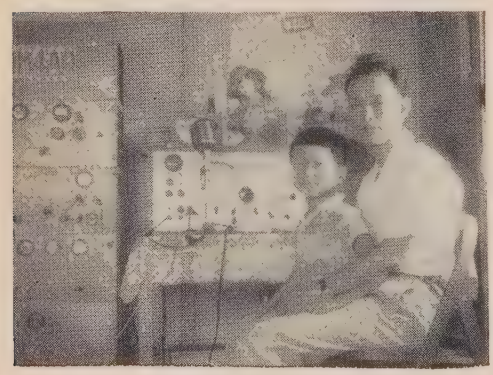
ent stations in the world as possible. (See last month's column for complete rules!)

As the first of its kind, the *CQ* Sideband DX Contest over the years has always attracted many sidebanders who ordinarily would never participate in a contest. However, due to the time element involved in disseminating contest information, there are occasionally some remote DX stations who are not familiar with the rules. It is requested that all possible publicity be given to this Contest in order to have the maximum participation. Although we have sent out by mail copies of the rules and the contest forms directly to many of the world's leading sidebanders, we would appreciate your help in talking up the Contest with your DX sideband contacts so that they will be ready, willing, and anxious to take part in this most popular of all sideband contests.

We would like to repeat our suggestion made in last month's column that contest activity be confined to the top 50 kc on 20 meters (which we imagine will be the most used band). Let us recognize that a large number of sidebanders do not participate in contests and that the sideband portion of 20 meters is large enough to accommodate both contestants and ragchewers if each keeps to his own area for the contest weekend. Why should needless friction exist? Let's use our heads and try to keep the top 50 clear for contest activity and the frequencies below 14.300 clear for ragchewing and phonepatching!

Again we remind you that log forms are available from the Sideband Editors at the above address. Send a large, double-stamped envelope for your share of forms. In returning your forms to us, please be sure that all the contest rules are complied with. The task of checking out logs is a difficult one and we do not have the time to figure out your score for you as has often been requested in the past. Be sure that your name and address and other pertinent information are included on your log and, if possible, send along a photograph. Everyone enjoys seeing who the contest operators are and who knows—you may be the Champion!

Good luck in the Contest to you all!



Although there are 29 hams now in Korea, there is only one sideband operator and he is HM4AQ, shown here with his Jr. op, in his all home-brew shack. He uses sideband on 7, 14, 21, and 28 mc. Orrie, W8BF, is his QSL manager. (Photo courtesy of Rundy OD5CT)

Sideband Around The World

KJ6BV finally sent his logs to Jim, WA6HOH, several months ago and no doubt all of you have received your cards. In those cases where you know that a QSL manager is handling the cards, a little patience is in order. Often the logs are not made available immediately and the QSL manager is harrassed by duplicate and triplicate requests for cards. Any QSL manager worth his salt gets the cards out to you as promptly as possible; any delay is an indication of a break in contacts between the DX station and his QSL manager. Wait your turn, boys; those cards will be in . . . The aforementioned WA6HOH is also QSL manager for Art, VQ2AT as of Nov. 12, 1961. Jim will take care of cards for all areas except Europe and Africa . . . Our favorite correspondent, KZ5SW, passes along the calls of the many operators now on sideband in the Canal Zone. KZ5LE got himself a KWM-2; Chuck, KZ5UC, ditto. KZ5SW and KZ5CG put up new Skylane fiberglass 3 band quads to boost their signals on 20 meters. KZ5DX is new on s.s.b. as are KZ5JJ (Jungle Jim); KZ5GS, Gloria; KZ5HX, Hop; and KZ5UB, Urda. Ted points out that the FAA group lives in a four block area! What QRM they must give each other! Incidentally, U.S. stamps are *not* good for use from the Canal Zone so don't send stamped envelopes! A self-addressed envelope with IRCs will get you your card direct from the Canal Zone . . .

A card from Bill, W2VZV, infroms us that Colin Richards, ex-AP2CR, GW3JET, is now at Kuala Lampur in Malaya. Colin's new call is 9M2CR and he has a new KWM-2 . . . At this writing, we're still waiting to hear how George, G3AWZ, sounds with his new rig. Not only did George have to wait some time to make the changeover but also conditions were so poor that no British stations were being heard on the East Coast. Let's hope that, by the time you read this, George is back in business at the old stand . . . In November, Johannesburg, South Africa, was the scene of many goings and comings. Olliver, ZS5JY, visited with Doug, ZS6TE, and his father, Bert, ZS6AFF for a weekend; the following weekend, Doug and Bert reversed the visit. During the same weekend, Peter, ZS6BBB, and Graham, ZS6AZD, visited with Dick, ZS6IP, at his hotel in Leydenberg. With Alan, ZS6NE, and Les, ZS6PC, holding down the fort in Jo'berg, the frequency was jammed with some of South Africa's top operators . . . A recent convert to sideband is Maurice, ZE6JA, who is doing exceptionally well with 80 watts from a phasing type exciter . . .

[*Continued on page 102*]

The USA-CA Program

BY CLIF EVANS*, K6BX

FORTY-EIGHT USA-CA applications have been received through December 1, 1961 as we go to press. Additions since those listed in last issue, in order received, include:

USA-CA-500

W8RQ	K7AGJ
VE3BKL	ZL1TB
W1RWP	DL9PF
W9GFF	DL1QT
W3BNU	K6YMZ

Number 2 USA-CA-1000 was won by K7NHG who followed K4BAI for this achievement.

Of the forty-eight applications now on hand, thirty-two were for mixed band/mode operations; eleven were for all-c.w.; one by PJ2AF for all-phone; one by W5NXF for all a.m.; one by W5AWT for all 14 mc; one by W6BIL for all 14 mc and all c.w.; and one by VE3BKL for all 14 mc and all s.s.b. Both USA-CA-1000 applications were for mixed operations.

Firsts for their (ARRL) countries, excluding W/K's, were PJ2AF, VE3BKL, KH6DKA, KL7MF, TG9AD, ZL1TB and DL9PF, all of whom are CHCers.

Applications from many parts of the world have not yet arrived so applicants are asked to be patient with the OLD MAN until we get the "fairness" aspects of the USA-CA Program firmly planted on bed-rock.

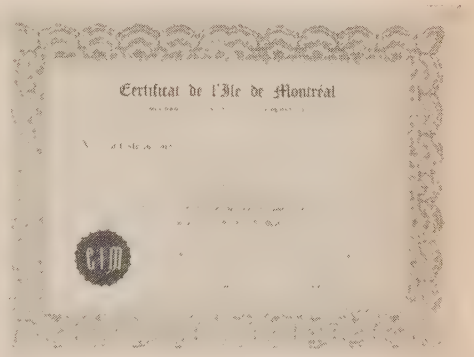
A few fellows report that the printer short-changed them on a page or so in the USA-CA Record book. Gosh, that's a failing of these automation type printing contraptions; just no safeguard against a skipped page now and then. If you should run across an unprinted page in the Record Book, be a Boy Scout and just throw in any kind of substitute listing and we'll accept it for sure.

The OLD MAN normally advocates use of loose leaf matter for amateur records and notes, as it facilitates multiple usages and adaptations. In the case of the USA-CA Record Book, it was bound with two staples to satisfy mailing requirements as a book and to insure complete applications; however, possibly some of you, as does the OLD MAN, might prefer a loose leaf version for the personal master copy. We found it quite simple to remove the staples, cut the pages even and punch with three holes for loose leaf binder. This also facilitates use of typewriter. As for Record Books sent in applications, rest assured we are not concerned with the shape the book is in when received; rather we are only concerned that it is complete and entries are proper.

*United States of America Counties Award Custodian, Box 385, Bonita, California

Canada

Last month we engaged in a bit of "humor" in chiding the sponsor of the Border Line Friendship award for leaving out Alaska and Yukon. As you know, the "Friendship" award is sponsored to publicize the thousands of miles of "Friendly Border" between the United States and Canada which is no more than a geographical separation as citizens of both countries travel without restrictions between the two.



Here is the Certificate de l'Ile de Montreal, a new award for working stations on the island of Montreal. W/K/VE stations contact 12 and others only 6. To get this award, send log data only and 50¢ to; Le Club des Jeunes Operateurs, Club Station VE2JC in Montreal.

Received a nice letter from CHCer Walt, VE3CWE explaining it really wasn't an oversight at all. As Walt says, had they required the Yukon, "Friendship" would have been too infrequent so what they are doing is giving added endorsements for Alaska and Yukon. Seems as though Yukon paste-boards are rather difficult to come by. Walt added that the OLD MAN was first to get the award with all endorsements. Walt reports "Friendship" awards have been issued to nine different countries and five continents.

See picture caption for another new Canadian award for working stations on the island of Montreal.

Amateur Radio an Educational Institution

Amateur radio by its very nature is a tremendous educational institution and media.

While most of hamdom learning is by haphazard association with new things and in being brought in contact with differing views by others, it remains true that the 'institution' has vast untapped educational potentialities for all ages. It remains only that hamdom leaders have foresight to crank painless educational features into various programs and this should be especially true with awards programs. The inherent value of any award has to be enhanced if it transcends the sheer fun aspects and adds to one's knowledge.

Many have already written recognizing the broad educational scope of the USA-CA Program. Actually the USA-CA Program had within its conception purposeful design to bring about better knowledge and understanding of our fifty semi-sovereign states with 3079 self-governing counties within which are tens of thousands of self-governing cities and towns in which free peoples are governed by laws rather than by man. The USA-CA Program encompasses within its scope *all* other U.S. awards programs and lends direct support to them including the USA-CA's educational aspects. It is simply just a case of engineered fun while learning which brings double satisfaction in achievements.

Likewise, one cannot digest the four stated "purposes" of CHC without realizing that CHC is not an award as such but a tremendous program promoting all areas and aspects of achievements and learning. CHC promotes itself by promoting all other hamdom achievements the same as USA-CA promotes its stature by promoting and supporting all other U.S. awards and related factors. Surely while this is somewhat a new approach, it presents a fresh and healthy accommodation to more universal fun with deeper value and educational significance.

What father of what son does not recognize in the USA-CA Program unlimited opportunity of educational values in many fields including Geography, Geo-Political Science, Government, together with all other Social Science and Humanity subjects? What better media to bring before the peoples of the world those things that make America great, not in material riches alone but in the strength of a free society? In the USA-CA Program, each and every one of us become an important contributor to its inherent educational processes while at the same time enjoying unlimited hobby fun and satisfaction.

Subject to the Editor's blue pencil, we will from time to time discuss those hamdom problems which have direct relationship with some of the goals of the USA-CA Program and, of course, the hundreds of club awards it champions and supports.

Hamdom Free Press

The OLD MAN would like to stress understanding and realization that amateur radio is an integral facility of the free press institution of world-wide communications. Except for the fact that amateurs cannot accept material gain for communication services, there are no major differences between our rights, obligations and responsibilities and those of radio broadcast stations, television stations, newspapers, magazines or whatever other facility of the media of communications between free peoples.

U.S. hamdom is a tremendous communication and educational institution with highly diversified activities, interests and usages reaching into many important needs of our lives and society. Amateur radio is not "just the boy down the street", nor is it something for selfish personal abuse. U.S. hamdom operates a world-wide communication media multiplied ten thousands of times and with millions of folks listening. We cannot communicate with others with thousands listening, without making and leaving "impressions." Let's face the fact, amateur radio is a major representative and symbolic voice of a free people's society and a media where *truths* give both publicity and strength to free peoples the world over.

We read today of false prophets who would attempt to gag our free speech over amateur radio channels and who would attempt to censure even the topics of conversations between free peoples. The right of free speech has never condoned or long-permitted uncultured or obscene matter nor does the law permit either libel or slander; however, these are not the things these people seek to control; their is attempt to gag and control a free press of which amateur radio is an integral part.

Each of us operating an amateur radio station is our own editor and our own commentator. As full fledged members of the free press media of world-wide communications we have an obligation and trust to be ever alert and vigilant in combating those who eternally seek to gag us or restrict us because today, more than ever before, a free press is a free people's best guardian against the evils of power and monopoly groups of whatever nature.

Also, on the positive side of the ledger, don't sell your vital individual rights or your country short. It is not propaganda to tell whole truths or to give publicity to the institutions of free peoples or a free society. We suggest that it is dangerous to accept or support the leadership of any person or organization that in any way would attempt to gag you from free speech whether amateur radio or any other related media of the free press.

Hamdom Public Relations

Closely related to the rights of free speech and a free press is hamdom's right to seek good Public Relations by the normal use of publicity vehicles and especially awards programs.

Be not led astray by those who would attempt to sell you a bill of goods that "PR" and the awards vehicle is an exclusive tool to be manipulated and exploited by any favored few. The awards PR vehicle belongs in the garage of

every organized amateur radio club. Fact is, there is no better method for the small or large radio club to sell themselves, their town, their county, their state, their country and amateur radio, than in sponsoring some significant promotional operating achievement award.

There are many constructive PR programs amateur radio organizations may sponsor to promote a free society's institutions and welfare. Cities and towns, counties and states can become joint sponsors in operating achievement programs celebrating events of significant national importance. It adds to the value of any award program if it is a part of some broader publicity program even though such is not directly related to amateur radio. Also, such relationships enhances hamdom's prestige.

An associated PR vehicle with which most of hamdom is interested, is the use of commemorative stamps. We reported to you previously that both Arizona and New Mexico were sponsoring Fiftieth Anniversary of Statehood awards programs during 1962. To show what can also be done, the Post Office Department will issue commemorative stamps for these occasions. First day sale of Arizona's statehood stamp will be February 14th in Phoenix, Arizona followed by sales elsewhere. New Mexico's stamps went on sale January 6th in Santa Fe.

The new Arizona Semi-Centennial Certificate requiring 35 Arizona stations to be worked during 1962 on any band, any mode. A list showing call, date, time, QTH and mode should be sent to the Arizona A.R.C., P.O. Box 7155, Phoenix 11, Arizona.

We are frequently asked for suggestions as to what would be a meaningful award with inherent values. Well, our answer in most cases is a research of the inquirer's state history with suggestion that the Chamber of Commerce of most states can provide a wealth of information on potential promotional projects for a ham club to take on. In many cases it ends up with programs at the state governor level.

Getting back to commemorative stamps, also coming up are: on April 6th a second of the "War Between the States" series, commemorating the centennial of the Battle of Shiloh; on April 11th, a stamp will be issued honoring Charles Evans Hughes on the 100th anniversary of his birth; first day sale of a special "Century 21 Exposition" stamp will be in Seattle, Washington, on April 21st; a Louisiana Statehood stamp commemorating that state's 150th anniversary will be issued April 30th; and others are the Homestead Act stamp on May 20th and some time in 1962 there will be a stamp to commemorate the United States contribution to the struggle against malarial fever. All the foregoing is given to show that every year amateur radio clubs are afforded excellent opportunity to get in on publicity already being generated at state and higher level.

Remember also, that Public Relations is your property the same as free speech and listen not to false prophets who would attempt to advise you that only they or their choice have some God endowed priority rights to use of awards as PR vehicles. Fact is, when you put the PR vehicle on the road, we'll help you with publicity to obtain better mileage. As you know, the USA-CA supports all U.S. awards and 'we' stand ready to lend a helping hand whenever possible.

Behind the USA-CA Scenes

Still in the talking stage are all-county awards for Mississippi, Iowa and North Carolina. Had hope that Louisiana's 150th year statehood would induce an all-county award from that state soon.

Many letters received asking about publicity for DX-peditions to 'rare' counties. As an example, WØCGQ, head of Radio-TV Department at University of Colorado, Boulder, Colo., wonders if folks would be interested if his group headed out on a long DX-P into many of Colorado and Wyoming's 'rare' counties? Well, as you all know, the USA-CA Program unfolds unlimited possibilities for field day, mobile, portable and DX-P trips to 'rare' counties. All we can say at this point is considerable interest already is present and all that is needed is for such trips to be well organized, planned, timed and adequate *advance* publicity be given. In the case of this column, we require 60 or more days advance info if we are to give coverage for any given month. We are interested in all such trips and we do care, so shoot along all such plans.

Don't forget the QCWA QSO Party this month. If you don't have a copy of QCWA's regular awards program rules or a list of QCWA members, drop K6BX an s.a.s.e. for same.

Well folks, that's it for this sitting. Have fun county hunting and awards hunting but remember the OLD MAN's admonishments that amateur radio is a vast free press institution of which you and your station is a vital part, and while you are having your fun, also contribute something significant to hamdom's educational processes. See you next month and in the interim, let's hear from you.

OLD MAN, K6BX

BY WALTER G. BURDINE, W8ZCV
R.F.D. 3, WAYNESVILLE, OHIO

Novice

Readers this month will note that W6TNS, former Novice editor has taken over as conductor of CQ's V.H.F. section. Walt Burdine, previous Novice editor from 1955 to 1957 has once again consented to do the chores for the Novice gang.

Walt Burdine, W8ZCV/AF8ZCV and K9BOU at his farm in Indiana, was born in Snell, Kentucky on April 25, 1914. He has been a member of the Dayton Amateur Radio Association for 24 years and was president of the club during 1960. He attended the Flat Rock School in Indiana and during the war-years worked for the War Emergency Radio Service. A bachelor, Walt is now employed as an Electronics Equipment Specialist for the Dayton Air Force Depot and in his off-hours works all bands, all modes. He holds, what we think is some sort of record in consistantly engaging in at least one QSO on the v.h.f. bands daily for 2,430 days and is still going strong! He claims only two prearranged schedules were required to keep the string unbroken, one of which was a QSO while he was hospitalized for surgery. He also holds WAS (YL), WBE, WAVE and YLCC. His shack is 26 feet in diameter, built on a tiled, concrete floor and equipped with a 2.5 kw generator for emergencies. Some of his close friends pictured at the shack are W8NAF, K8KNQ, W8YJB and K8VOT. Walt has helped hundreds of youngsters with their Novice ticket and we're sure you'll find his column interesting and informative. Welcome back Walt!

Dear Readers of NOVICE Column.

I'm glad to be back as your editor; my last column in *CQ* was in February 1957. I want to take this opportunity to personally commend Don Stoner, W6TNS, for the excellent job he has done as your editor. I had the pleasure of meeting Don at the 1961 Dayton Hamvention and greatly enjoyed the chat. Good luck with the V.H.F. Column, Don.

The ranks of amateur radio operators are growing rapidly and still others are desirous of becoming hams. My aim is to help anyone wishing to become an amateur and, at the same time, try to make it an enjoyable chore. I will do my best to help you gain the necessary technical background. My aim is not to get you licensed by memorizing the license manual; you will never be a good ham that way. You will never add anything to the stature of the ham operator unless you are willing to learn the amateur's code and live by that code and unless you yourself are willing to study and

eventually help another to gain the distinction of becoming a ham. You gain the most pleasure of your know-how by sharing it with someone less experienced.

Don't forget, fellows and gals, this is your column and that I am just here to co-ordinate the letters, hints, kinks and ideas that you as novices and technicians send to me in your letters. With your help in writing letters, sending pictures, reading the column carefully and telling someone else to read the column, we can make this a clearing place for ideas and necessary information for the betterment of our hobby. This should be a cooperative venture; I promise to do my part. If you write a letter that needs an answer, I will answer it as soon as possible. Let's make this column grow.

It has long been my opinion that the easiest way to learn radio is by building radio gear. Learn by doing and you will learn well. I will try to get you on the right track and you can take it from there. Be sure to keep studying the code while you're building station equipment. Also, you must know the FCC rules and regulations. Too many people are not acquainted with these regulations and often fail the exam because of just this.

Power Supplies

One of the most needed articles around the ham-shack is an assortment of power-supplies to power your home constructed ham equipment. I recommend that the starting amateur build his power-supply on a small chassis with standardized plug connections for power input, output and control circuits. Interchangeable power input, output and control circuits will make for flexibility or design, operational ease and its use as a primary power source. This flexibility is often the means of keeping equipment on the air after the built-in power supply has quit, it has saved a good number of incomplete QSO's for me.

I have five power supplies that will enable me to run any transmitter ranging in power from 1 watt to 500 watts. The high-voltage can be adjusted for 10 volts to 1800 volts with currents up to 400 ma. The filament voltages range from 1½ volts to 35 volts either a.c. or d.c. A lot of construction time is saved by having readily available power at hand and ready to plug in. As time progresses I will give you diagrams of these power-supplies, not so that you may copy them but so that you can see the ideas behind their construction.

This month we will go into the theoretical and operational functions of the power supply. A power supply is needed for any piece of equipment used in the ham-shack, it must be able to supply power of different voltages and current ranges to the equipment. Some of these can be alternating current and some will have to be rectified and used as a source of direct current (d.c.) supply. Three different voltage sources are needed in most equipment. The "A" supply is used to heat the filaments of the tubes and to light the pilot lamps, and can usually be alternating current (a.c.). This a.c. can be obtained from a low-voltage winding on the power transformer. This winding is referred to as the filament winding and is the winding with the heaviest wire, due to the fact that it carries the most current. The "B" voltage is used to supply the plate or anode voltages and is usually the highest voltage on the transformer while the lowest current flows in this winding. The B voltage must be rectified and filtered to supply direct current. The amount of alternating current component left in the B voltage after filtering determines the hum level in the output of the equipment powered by that power-supply. The "C" voltage is used to supply the bias voltage for the tubes and must be well filtered direct current. In small equipment the C voltage is often supplied from the B supply by placing a resistor between the cathode and the ground or B– terminal. The total current flowing through this cathode resistor is the sum of the currents used by the tube, *i.e.* plate, grid, screen-grid and suppressor-grid currents, as this is the ground return for all of the tube elements. The actual plate voltage is the voltage measured between the cathode and the plate while the difference between this voltage and the B+ is the C voltage.

All a.c. operated power supplies may be divided into four parts: the transformer, the rectifier, the filter and the bleeder or voltage divider system. We will now proceed to discuss the various components in detail.

Transformers

The transformer provides a means of increasing or decreasing the voltage as needed for the different parts of the circuit. One of the laws of electricity states: If a wire is moved within a magnetic field, a voltage will be induced in that wire. Another set of conditions producing the same effect is: A changing mag-

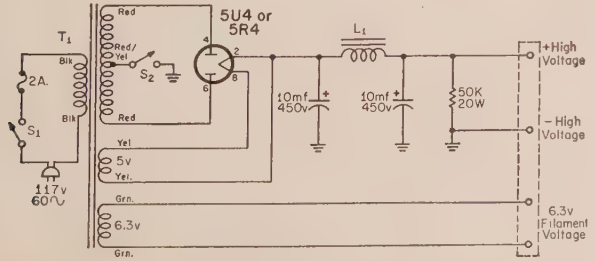


Fig. 1—Schematic of a simple power supply suitable for construction by the beginner. Transformer T_1 is described in the text or may be a Thordarson T-22R06. S_1 is the a.c. On-Off switch while S_2 is used to turn the high voltage on and off. Filter choke L_1 is discussed in the text.

netic field will induce a voltage in a wire located there-in. This is the basis of transformer action.

The transformer consists of a magnetic core material wound with copper wire. (The windings are all insulated from the core). The winding into which the input voltage is fed is called the primary; the rest of the windings are called secondary windings. The voltage of the secondary winding is proportional to the turns ratio of the windings. It can be either higher or lower than the primary voltage. The current in the primary is proportional to the current drawn from the secondary. Sometimes two or more transformers are used in a power supply. The one supplying the high voltage (plate supply) is called the plate transformer, while the ones supplying the filaments are called filament transformers. The power supply is usually the most expensive part of a transmitter and this is the reason for making power supplies interchangeable.

Transformers can never be used on direct current. This would quickly ruin them. Their function depends upon the use of alternating current and the resultant changing magnetic field.

Rectifiers

If certain metals, or metallic oxides are heated to a high temperature (by passing a current through them) they have the property of throwing off, or emitting, electrons.

The element in a vacuum tube that is heated is called a cathode. Two types of cathodes are used in radio tubes. In one, known as the filament or heater type, the heating current is passed through the cathode itself. In the other, the indirectly heated type, the current flows through the filament (a heating element) which in turn heats the cathode to a temperature high enough to emit electrons. In the indirectly heated type, the cathode is an oxide-coated sleeve placed around the filament or heated element.

In our power supply we will be concerned only with the diode, a two element tube comprised of the filament (heater) and the plate or anode.

The diode acts as a conductor when the voltage on the plate is positive, and a non-conductor when the plate voltage is negative. This property of the diode lets us use the diode for rectification or changing a.c. to d.c. The cathode emits electrons, negatively charged particles of electricity. One of the laws of electricity states that like charges repel and unlike charges attract. Therefore if a plate with a positive charge on it is placed near the cathode, a flow of electrons will result from the cathode to the plate. This condition of flowing electrons is called conduction. It should be noted that electrons travel from *negative* to *positive*.

We shall center our discussion around the vacuum-tube rectifier in this power supply. Rectifier tubes are made in both half-wave and full-wave types. When using half-wave rectification the ripple or "left over" a.c. in the output of the rectifier is at the same frequency as the input frequency. In a full-wave rectifier the ripple frequency is twice that of the input frequency. The output voltage of a full-wave rectifier is easier to filter, due to the higher frequency of the ripple contained in the "pulsating direct current" coming from the rectifier.

The Filter System

The filter system smooths out the pulsating direct current component as supplied by the rectifier and makes it nearly pure direct current. The components of the filter system are called capacitors and chokes. We shall go into more details about each of these parts. The choke is a fixed inductor or coil that offers a high resistance to the flow of a.c., while it shows a low resistance to the flow of d.c. By this action, the choke coil will easily pass d.c. but will tend to block or "choke" off the a.c. components of the voltage supplied by the rectifier. Large iron-core choke coils are used in the filter system of a power supply system.

Filter chokes are made by winding a multilayer bank of wire on an iron-core enclosure. The wire must be insulated from the core material sufficiently well to withstand the maximum voltage supplied by the rectifier. The maximum voltage is usually about one and one half times the voltage measured at the output of the rectifier. The larger the inductance the better the filtering action afforded. The unit of inductance, the henry, is used to tell the inductance of a choke. The resistance of the choke will determine the voltage drop across the choke; voltage drop is equal to the current (in amperes) drawn through the choke multiplied by the resistance in ohms. A swinging choke, used in a power supply using two chokes, changes its inductance inversely with an increase in the amount of current drawn through it. The use of a swinging choke improves the voltage regulation of the power supply when the load on the output is of a variable nature.

The Filter Condenser

A capacitor is a circuit element designed to introduce capacitive reactance in a circuit. The unit of capacitance is the microfarad (mf). The capacitor passes (for our purpose) alternating current and blocks the passage of direct current. The capacitance of a capacitor determines the amount of a.c. that it will pass. The primary purpose of a filter is to remove the a.c. components of the pulsating direct current and to pass the direct current through the filter network. The amount of a.c. component left on the high voltage at the output of the filter will determine the hum level in our equipment. Capacitors used in filter circuits are commonly called filter capacitors. The voltage rating of a filter capacitor should be high to prevent

[*Continued on page 110*]

ham clinic

CHARLES J. SCHAUERS, W4VZO
c/o CQ, 300 WEST 43rd ST.,
NEW YORK 36, N. Y.

TODAY'S ham radio receiver manufacturers have made it relatively simple to own a well designed receiver at reasonable cost. However, there was a time when the ham had to "roll his own" if he wanted to get on the air—and what a time he had getting parts!

Except for a patient and knowledgeable few, most hams utilize commercial receivers already assembled or receivers they have assembled from kits. Gone is the day when the ham had to devote many hours to debugging a regenerative or superheterodyne receiver to make it perform properly.

What seems to frighten the average ham away from home receiver construction more than anything else, is the mechanical work connected with the task . . . it is not easy, and requires more than just a pair of pliers, a soldering iron and an electric drill.

Some hams do not realize how much engineering and pre-production testing go into the average communications receiver before it is released to the market. It must be remembered too, that a large part of the total receiver cost (to the customer) can be attributed to research and engineering.

An average a.m.-c.w. transmitter capable of 100 watts output can be built (starting from scratch) in about 100 hours; to come up with a good stable receiver with the latest circuitry will take at least twice this time! So you can see why the average ham does not have too much interest in building his own receiver.

Unless one has a lot of spare time, a well equipped workshop and an oscilloscope, r.f. signal generator, vacuum tube voltmeter, grid-dip meter, impedance bridge and a good frequency meter, he had better forget about receiver design and construction. For without these, one cannot come up with a receiver comparable in price and efficiency to commercial jobs.

A good receiver is characterized by good sensitivity (a microvolt or less); variable selectivity for c.w. and s.s.b., a.m. phone; frequency stability (after warm-up) within reason; good image rejection and ease of dial calibration.

The R.F. Stage

The r.f. stage seems to come in for more attention by hams than nearly any other stage in a receiver. Some young hams think that merely by changing an r.f. tube with the "latest" low-noise, high-gain tube they can make their sets perform as do some of the higher priced receivers. In some isolated cases this is so, but more often than not, changing an r.f. tube does little good unless other changes are made in associated circuitry.

An r.f. amplifier stage in a superhet receiver is a necessity, if improved rejection against undesired signals, better gain, better image frequency rejection, improved signal-to-noise ratio, reduction of spurious frequency combination effects and little or no radiation from the set's local oscillator are desired.

But regardless of how efficient the r.f. stage may be in a receiver, if i.f. frequencies have not been well chosen and the i.f. stages well designed, a mediocre receiver will be the result.

Coupling to the antenna from the r.f. stage is usually accomplished by utilizing an antenna coil, the primary of which is generally tuned by a small capacitor (antenna trimmer) to reduce the effects of transmission line reactance and provide for maximum signal transfer.

Output coupling of the r.f. stage is accomplished by using a simple parallel tuned circuit, r.f. transformer, capacitance choke-coupling or in some cases, a combination of these. If an r.f. transformer is used, the windings must have a proper coefficient of coupling between windings and a reasonable Q. In any event, there will be a compromise between selectivity, gain and errors in tracking.

A receiver containing two well designed r.f. stages is better than a set with only one r.f. stage. However, one must remember that when an r.f. signal is amplified so is accompanying noise. As yet, no one has found a practical solution to the elimination of noise prior to amplification of an r.f. signal.

New tube types for r.f. amplifier applications have increased the signal-to-noise figure, but as long as tubes use hot cathodes for electron emission we will continue to have "white" or "shot" noise. New r.f. amplifier techniques at the ultra-high frequencies, i.e., parametric amplifiers etc., have reduced the noise figure, but at the lower frequencies we are still at the "horse and buggy" stage of noise reduction.

The utilization of a grounded-grid r.f. amplifier stage is generally a necessity at the very high frequencies and will give a higher signal-to-noise ratio, but this will usually be at the expense of selectivity.

It must be realized that the gain and selectivity of any r.f. amplifier that is tuned may vary with the input r.f. signal frequency. This is why we must depend upon well-designed fixed tuned i.f. amplifiers which will nominally give greater gain per stage at a constant rate for a given band of frequencies.

Remote cut-off pentodes like the 6BZ6 can be used to good advantage in the r.f. stage of a receiver. If you wish to try to improve your old receiver which contains an r.f. pentode stage, by using the 6BZ6, make sure that you provide 250 volts to its plate, 150 volts to the screen. Couple the secondary of the antenna coil to its grid through about 30 mmf (ceramic capacitor). An r.f. gain control (if there is not one) can be installed merely by inserting a 10K potentiometer in series with the cathode to ground. If there seems to be a small amount of regeneration, install a 47 ohm resistor in series with the cathode and pot, and bypass the top end to ground with a .01 mf capacitor.

Instability in r.f. amplifiers is not uncommon in homebuilt receivers. It can be due to improper shielding of input and output sections, i.f. feedback (fundamental or harmonics) stray coupling between the antenna coil and r.f. transformer (connections) and tube inter-electrode capacity coupling.

The I.F. Amplifier

As we know, in the superhet, i.f. stages are utilized after the r.f. stage to obtain uniform amplification of a heterodyned signal. The signal coming from the r.f. amplifier is mixed in a mixer or converter stage so that the resultant is the i.f. The choice of the proper i.f. is important.

When the i.f. is made too high, one will encounter tracking difficulties in oscillator and signal circuits and there will be a reduction in selectivity and gain. On the other hand, if an i.f. is made too low, one will run into a lot of image interference.

The reason one will not find an i.f. selected for a receiver which falls within the receiver tuning range is that there would be strong heterodyne interference and very severe instability.

Various intermediate frequencies are used in ham band receivers. These i.f.'s range from a low of 50.5 kc to 1650 kc or higher, depending upon whether or not the receiver is a double or triple conversion set.

The most often encountered i.f. is 455 kc. This i.f. along with 1600 kc has been used by more manufacturers for ham receivers than any others.

Gain, selectivity and cost, control the number of i.f. stages used in amateur type receivers.

Since the U. S. Sonics Corporation, 63 Rogers St., Cambridge 42, Massachusetts introduced their permanently tuned, ceramic i.f. transformer, receiver designers now can replace the old style bulky i.f. transformers which require very careful tuning for proper band-pass and desired selectivity.

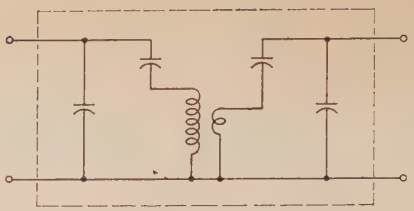


Fig. 1—This shows the approximate circuit diagram at resonance of the ceramic transformer. It should be noted that the overall gain is equal to or better than the conventional i.f. transformer and that filters are availble having different input and output impedances to match the circuitry associated with both tubes and transistors.

Actually, the U. S. Sonics i.f. transformer is actually a filter which is not a direct substitute for transformers now installed in present receivers. However, with the proper arrangement of circuitry these filters can be used in a number of applications of interest to hams.

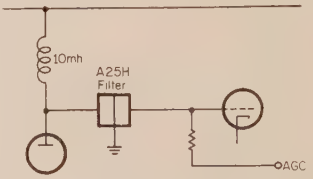


Fig. 2—Basic diagram showing the A254HC filter in a tube circuit.

At the present time, U. S. Sonics offers two models of their filter. Both models are for 455 kc ±1 kc. The A254HC is specifically for vacuum tube circuits and has a 25K input impedance and a 200K output impedance. The A10019C is for transistor circuitry and has a 10K input impedance and a 1K output impedance. Because the filter acts like a symmetrical transformer it can be wired into a circuit with either of its leads as the input. The case of this tiny device (no bigger than a medium sized transistor) serves as the r.f. ground connection.

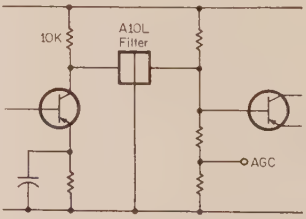


Fig. 3—Basic diagram showing the A254HC filter in a transistor circuit.

There are no d.c. connections to the filter so the designer must incorporate the necessary separate biasing for transistors and tubes.

The filter exhibits only 1 db of power loss! (Some conventional i.f. transformers will exhibit as much as 14 db loss.)

The ceramic i.f. transformer (filter) has a great future in hamdom if U. S. Sonics will

just explore the field and manufacture the units required. I can envision their use in s.s.b. filter work, pan-adaptors, selectivity control, etc. Because no alignment is involved (for receiver i.f. use) I can see wider use of these units in receiver kits.

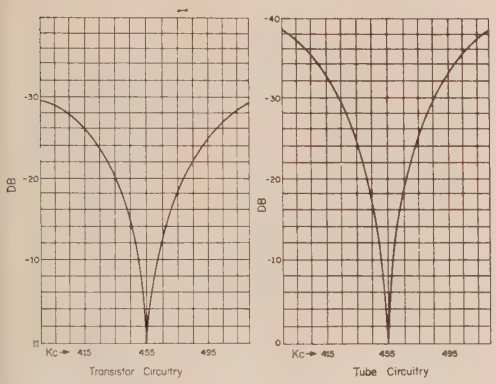


Fig. 4—The characteristic curves of standard production units.

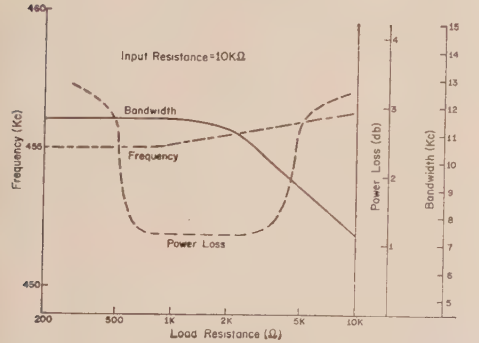


Fig. 5—This represents the effect of load impedance on the A1009C filter.

HAM CLINIC's thanks to Eric A. Kolm of U.S. Sonics for supplying us the information on the filter that I am sure we will hear more of.

Construction

Although I have not mentioned the oscillator, converter, audio and other stages of the superhet receiver, their proper design is no less important than the r.f. and i.f. stages. However, the lack of space precludes their consideration at this time.

Those who have the patience, tools and instruments to construct a receiver know that mechanical lay-out is an all-important item and one that cannot be treated lightly. Components which control oscillator frequency must be mounted as far away from heat producing components such as tubes, transformers, chokes etc., as possible. The i.f. strip must be one integral unit to cut down inter-stage transfer loss.

The ham who constructs his own knows that the most difficult task connected with his project is that of dial calibration—especially if he builds an all-band job. Mechanical stability of tuning elements is not easy to come by in a home lab.

As a final thought, I have built some of my own receivers and I have operated receivers built by others. Some of these sets worked as well or better than some commercial jobs, but their design, construction and modification took time—lots of time.

Future Receivers

Within the next five years new and more efficient receiver components will be developed and the transistor will really come into its own.

Judging from letters received from ham readers, the average ham wants a receiver with better than 1 microvolt sensitivity, variable selectivity, frequency stability and ease of dial calibration down to at least 250 cycles. He wants s.s.b. receiving provisions and scope or pan connections. The manufacturer who can give him all of these for around $200.00 will have a best seller.

Questions from Beginners

This month, HAM CLINIC presents questions received from beginners. We define the beginner as the Novice, the new General licensee or someone who is studying everything he can lay his hands on to learn more about ham radio with the objective in mind of getting a ham license.

Doublet Matching "Is it true that all doublet antennas can be terminated with 72 ohm coaxial cable?"

No, only the "straight" doublet. The folded doublet must be terminated with 300 ohms. TV line (300 ohms) may be used with a folded doublet safely with power outputs up to 250 watts.

Electrolytics "Is it all right to parallel two electroylytic capacitors of different capacity values as long as the voltage ratings are the same?"

Yes. In fact in some cases this is a desirable practice as it distributes the leakage dissipation (leakage voltage times applied voltage) between the two capacitors. This lowers the operating temperature of each capacitor and may prolong the capacitors' life.

Phone Patch "Would you show me by diagram how to make a phone patch connection within my telephone?"

No, this practice is forbidden by the telephone company.

Oscillator "How about a good third-overtone crystal oscillator circuit?"

See January 1962 column, p. 72.

DX-40 "You have said the transformer in the DX-40 is too small to handle a plate modulator. Well then, I still want to plate modulate this little rig—what is your practical suggestion?"

My practical suggestion is to obtain or build a complete modulator with its own power supply. The modulator should be capable of between 30 and 35 watts output for full 100% modulation of the 6146 in the DX-40. There is little room in the DX-40 to build in a plate modulator. If you load that DX-40 properly and do not try to modulate "the pants off" it, the rig will sound fine. If you are using a crystal mike and get reports of too much bass, reduce the size of the coupling capacitors in the mike input stage.

Stray R.F. "I can light a neon bulb on the cabinet of my transmitter when it is on. Sometimes I get a little burn when I touch the mike with my lips. What can I do to eliminate this stray r.f.?"

First make certain that your transmitter final is connected to a good resonant antenna and that you have a low standing wave ratio. Next, check your ground and make sure that it is direct and of low resistance. Then, if you still have stray r.f. at your mike, connect an r.f. choke in series with the center mike lead (within the transmitter) and bypass it to ground with a .001 mf ceramic capacitor. If this does not do the trick, try a different length of mike cable to get away from those "lip tweaks."

Code Speed "Since becoming interested in ham radio I have heard so many people extoll their particular methods of getting one's code speed up that I am confused. Tell me, what do you suggest for someone who cannot seem to get over 7 words-per-minute?"

Most young hams try to learn the code by sight instead of sound when starting out, and they pay for this when they wish to increase their code speed. As I have said before (and say again), learning the code is like learning the sound and meaning of a new word. My advice to you is to get the assistance of a ham-in-being and have him teach you the alphabet letter-for-letter (randomly) and not to worry about speed. After you have learned the alphabet, tune in on the ham-bands and try to copy as many letters as you can. Do not worry about words. Pick a station that is going just a little faster than you think you can copy. Don't worry about missed letters or words. Send to yourself at least 15 minutes each day and listen. It takes consistent practice to reach that 13 words-per-minute, but when you can copy at this speed, 15, 20 and even 30 words per minute "are just around the corner". The guy who says he can't learn the code does not know what he is talking about—if he can learn the sound and meaning (and use) of a new word (in any language) he can learn the code.

Extra Class "I got my General class license last year. Think I ought to go up for the Extra class? Is it worth the effort?"

I do! When you study for your Extra class you are learning and this is achievement. After studying for and obtaining my Extra class license I got a great sense of satisfaction out of entering the "top fold". Perhaps there are no extra privileges connected with the highest ham license (maybe there will be), but I say that the ham who has the Extra class license is a better ham technically than his general class brother. The Extra class license examination is not easy. . . . I know, because I found it just about as stiff as my two commercial exams that I took in 1938.

Warrior Bias Heath tells us that the zener diode method of W1NXY for improving the bias voltage stability in the Warrior (Nov. 1961 *CQ*) works fine but seems a mite expensive when the job can be done simply by merely making C_{18} a 1000 mf unit, rated at 50 volts. This will do away with any hum.

Transistor R.F. Power Amplifiers "Where can I get more information relative to transistors used as r.f. power amplifiers for amateur radio applications?

See your RCA distributor and ask him for the December 1961 issue of *Ham Tips*. It contains a real fine article by WA2CMR/6 (J. B. Fisher) on the subject.

Taylor Modulation Rig Herb Romine who authored the Taylor Modulation rig using 4-400As in the October 1961 *CQ* column writes and says that he has had a lot of mail relative to his design. First off, his call is W5LSO and his address is P.O. Box 217 Burns Flat, Oklahoma. The antenna loading capacitor in the diagram is shown as fixed when it should be variable. The plate tank capacitor should be a dual section unit. The capacitors in the mod. circuit should be .04 mf, *not* 0.4. The capacitor in the center tap of the mod. transformer secondary should be .004 mf.

Thirty

HAM CLINIC appreciates the assistance of readers and is very happy to receive technical tip items for publication. However, we cannot accept items which you have already sent or intend to send to another ham publication. A recent item appeared in *QST* after it had been published in *CQ*, the author of which no doubt not knowing that this is not an accepted practice. Copyright laws are a mite "sticky."

Most magazines usually have a three months preparation deadline. That is, material for the May issue for example, is prepared in March. So if your item is accepted you have a *minimum* 90 day wait. However, we acknowledge immediately any items received and try to forecast when they will be published. Unless there is an emergency of some sort, the item will appear when we say it will. One cannot be impatient with magazine deadlines.

When you send in a technical tip you are helping other hams. You can bet that when it is published it will be seen by no less than 90,000 pairs of eyes . . . and perhaps more.

Again, thank you for reading HAM CLINIC and please be patient waiting for an answer to your letters—we are doing our best under the avalanche!

73 and 75, Chuck

RTTY

BYRON H. KRETZMAN, W2JTP
300 W. 43 ST.
NEW YORK 36, N. Y.

RTTY Operating Frequencies

Nets centered on frequencies given; operation usually ± 10 kc.

80 meters	3620 kc
40 meters	7040 kc
20 meters	14,090 kc
15 meters	21,090 kc
6 meters	52.6 mc

FOR a long time, for many years in fact, your monthly RTTY COLUMN has been proclaiming to the world of amateur radio that radioteletype is neither expensive nor complicated. And, you don't need a 7 foot rack cabinet housing hundreds of pounds of gear to convert a radio signal into the d.c. required to operate a teleprinter machine. Everything you need, besides the transmitter and receiver, can be put on one chassis if you use vacuum tubes. If you *transistorize*, it can even be more compact.

RTTY-Transistorized, Part I

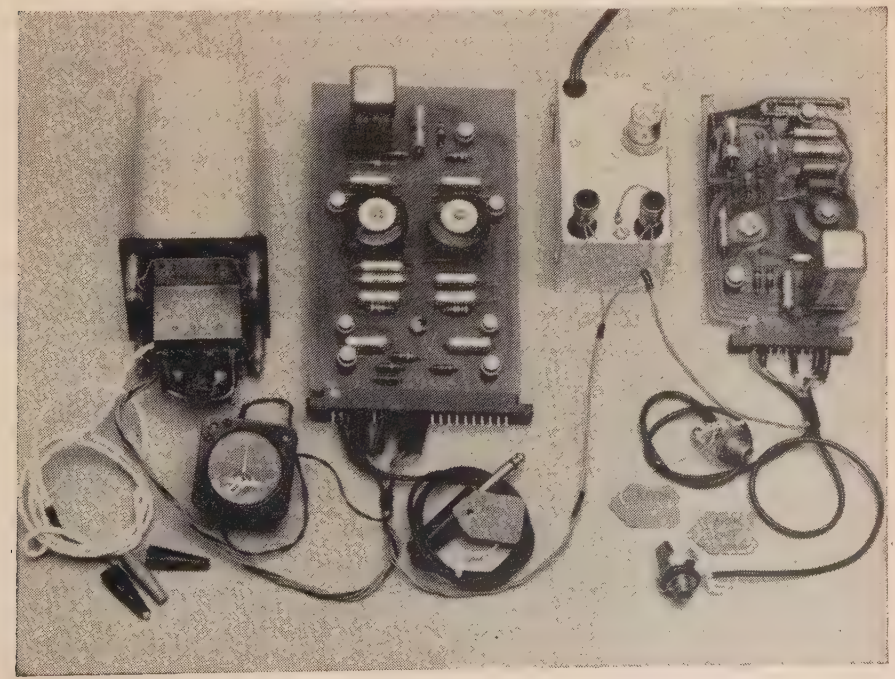
The accompanying photo shows the essential equipment, laid out side by side, that you need to operate RTTY, either a.f.s.k. on the v.h.f. bands or f.s.k. on the lower frequencies. From left to right, there is: a polar relay, the converter or terminal unit (TU), the power supply, and the a.f.s.k. oscillator. A little surplus zero-center milliammeter used as a tuning meter is also included. Switching this gear from receive to transmit is left to the discretion of the user, and can be in the form of a multi-contact key lever switch or a relay.

The W2JAV Transistorized TU

Phil Catona's original transistorized TU was described back in the March 1958 RTTY COLUMN in *CQ*. This particular TU was not intended to be the "last word" in TU design, but rather was intended to point the direction of exploratory thinking. Since that time Phil has built a good many versions of this unit, constantly improving its performance without adding undue complexity. But, it should be noted that even in its original form this TU was better than the average.

The pictures show the latest version, single-tuned per channel, of this excellent converter. Phil calls this "Project DESPAIR" because of the heartache associated with obtaining the printed circuit boards. These are not easy to come by. Phil has supplied many *hand-made* boards to local RTTYers. In addition he has supplied the photo masters and negatives to

W2JAV's Transistorized RTTY Gear.



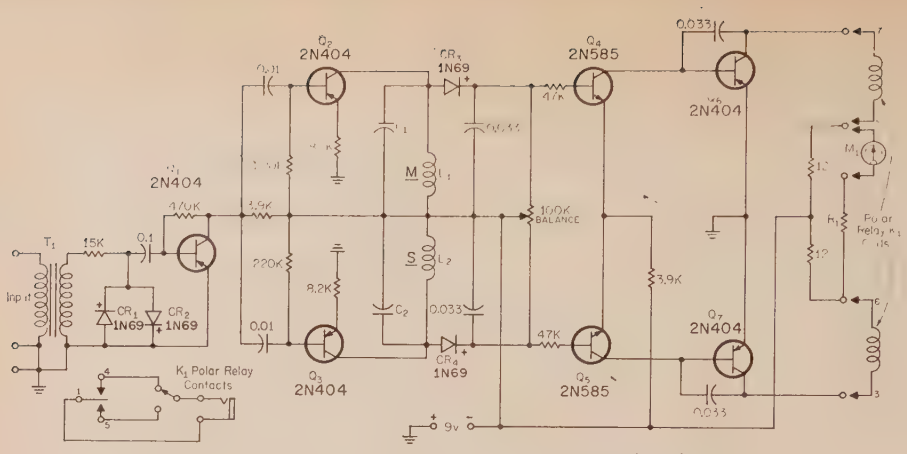


Fig. 1—Schematic Diagram of W2JAV Transistorized Polar Converter.

C_1—.066 mf, 100v, Sprague Vitamin Q. Vary if necessary to tune L_1 to 2125 c.p.s.

C_2—.033 mf, 100 v, Sprague Vitamin Q. Vary if necessary to tune L_2 to 2975 c.p.s.

K_1—Western Electric 225A with W.E. 18B socket.

L_1, L_2—88 mh toroid telephone loading coils.

M_1—Zero center milliammeter, 1-0-1 ma.

R_1—1000 ohms. Vary to get desired reading on M_1.

T_1—600 Ω to 19,000 Ω. FTR TF1A19 (W2EWL Special) or equivalent.

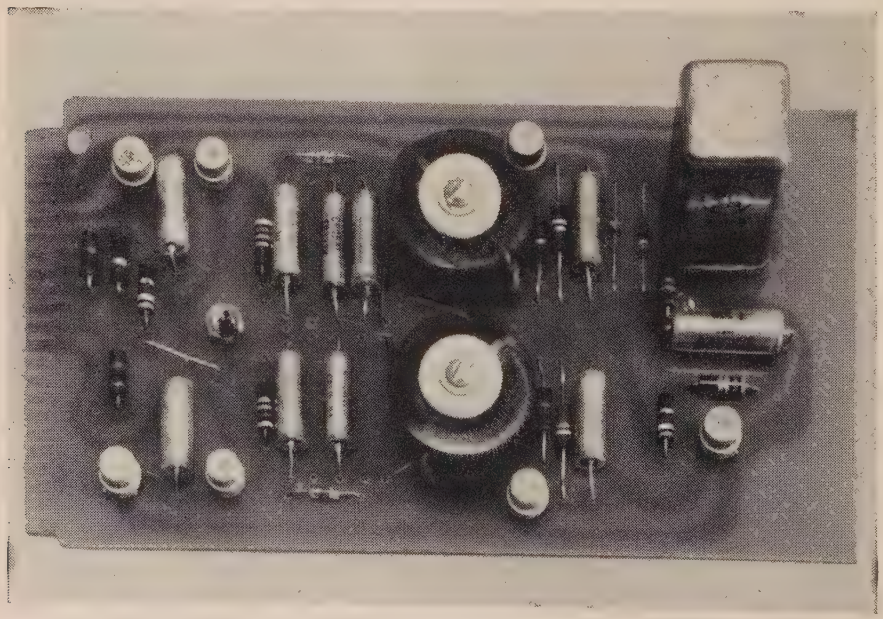
several people who promised to have a quantity of boards made up and then made available to the RTTY fraternity. All to no avail. (*Now, don't write Phil for a board or for the photo masters or negatives. He just hasn't the time or the facilities. Write to the RTTY Editor, if you must.*)

Now, there is another approach to the ingenious RTTYer. It is not vital that you use a *printed circuit* wiring board. This TU can be electrically duplicated, without increasing its size, by using the miniature "peg board" and "flea clips" available from and in the catalog of Lafayette Radio, Box 10, Syosset, New York. The board is cut to approximately 4 inches wide by 7⅛ inch long, and the flea clips are installed roughly in the same relative positions as the holes in the printed circuit board. Thin plastic covered wire is used to wire the board. Other flea clips are used as a terminal strip for external connections, or you can install a miniature plug of your choice; there are several listed in the Lafayette catalog.

The Circuit

Figure 1 is the schematic diagram of this version of the polar transistorized TU. The input transformer is surplus, the "W2EWL

Component side of printed circuit TU.



Printed circuit side of transistorized TU, note the back of the Balance pot.

Special" used in s.s.b. and available from Barry Electronics (see their ads in *CQ*) as type "TF1A19" for around $1. The slightly larger surplus "GH-1202-2", also available from Barry, is just as usable. Several small satisfactory substitutes also can be found in the *Argonne* line sold by Lafayette Radio. Anything close to a 500 or 600 ohm primary and a 20,000 ohm secondary will do.

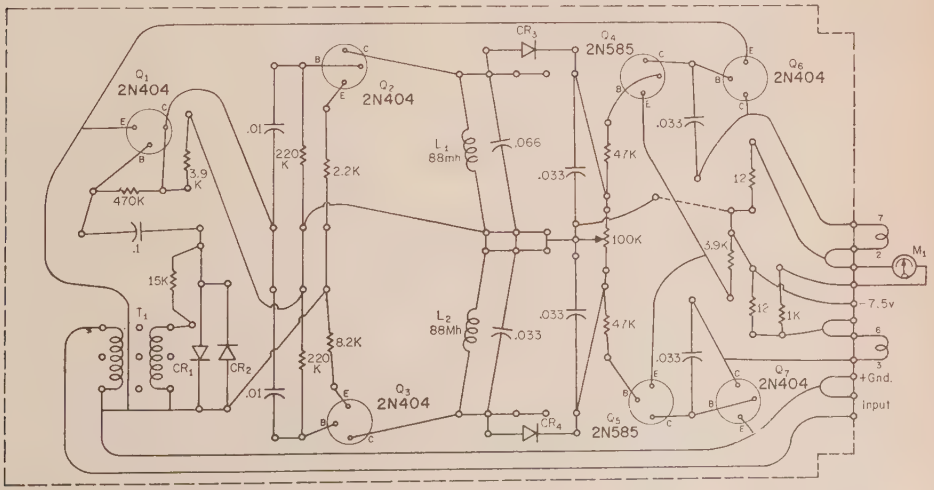
A pair of 1N69 diodes are connected back-to-back to set the limiting level since the first stage, Q_1, begins to limit on only 0.3 volt. Transistors Q_2 and Q_3 are used as a phase splitter with the collector circuit of each containing the tuned circuit, one for *mark* (2125 cycles) and the other for *space* (2975 cycles). The inductors are the usual 88 mh telephone loading coil toroids and the capacitor values given are approximate. The load resistor for the diode detectors CR_2 and CR_4 is the 100k ohm BALANCE potentiometer. This control permits compensation for the slightly different levels in the *mark* and *space* channels. Two type 2N585 npn transistors are directly coupled to separate 2N404 pnp transistors with a WE 255A polar relay connected in the collector circuit of each. Note that no power transistors are needed to operate the polar relay.

Performance

Audio sensitivity of this remarkable little TU is about 1 millivolt (0.1 volt r.m.s.) and it has a limiting threshold of 3 millivolts. With the d.c. power supply at 8 volts, each side of the polar relay is hit with a pulse of about 30 ma, and a full 80 point machine range is obtainable. With the complete absence of audio input, less than 2 ma is drawn by the entire TU! This extremely low drain makes it quite feasible to use an ordinary dry battery as the power supply, and it then becomes practical to go

[*Continued on page 112*]

Fig. 2—Printed circuit board parts placement.



DONALD L. STONER, W6TNS
P.O. BOX 137, ONTARIO, CALIF.

semiconductors

ONE of the space-age semiconductors which has not been discussed in this column is the silicon solar cell. These interesting devices have been used on our space age vehicles for some time. For example, see the accompanying photograph of Tiros, the weather picture taking satellite. Almost its entire surface is covered with solar cells.

Actually there are several types of semiconductors which are mis-labeled solar cells. The photocell, or selenium photovoltaic cell, has been available to amateurs and experimenters for years. These devices are relatively easy to make and therefore quite inexpensive. They do not, however, produce sufficient power to be more than a curiosity for amateurs. These cells are commonly used in illumination controlled cameras because they can be easily contoured and their spectral response is very similar to the human eye.

Another type of photocell is made from cadmium sulfide. Unlike the selenium photovoltaic cell, the CdS cell does not convert illumination into electricity. Rather, it changes resistance radically when illuminated and therefore also qualifies as a semiconductor. A typical cadmium-sulfide cell might exhibit several megohms terminal resistance when shielded from light. When the cell is illuminated, the resistance would drop to 2 or 3 thousand ohms. The wide resistance change produces great sensitivities and makes the CdS cell quite useful in alarm systems.

Neither of the devices described qualifies as a solar cell. That term is reserved for the silicon photo energy converter associated with our satellite programs. Let's see how these intriguing devices function.

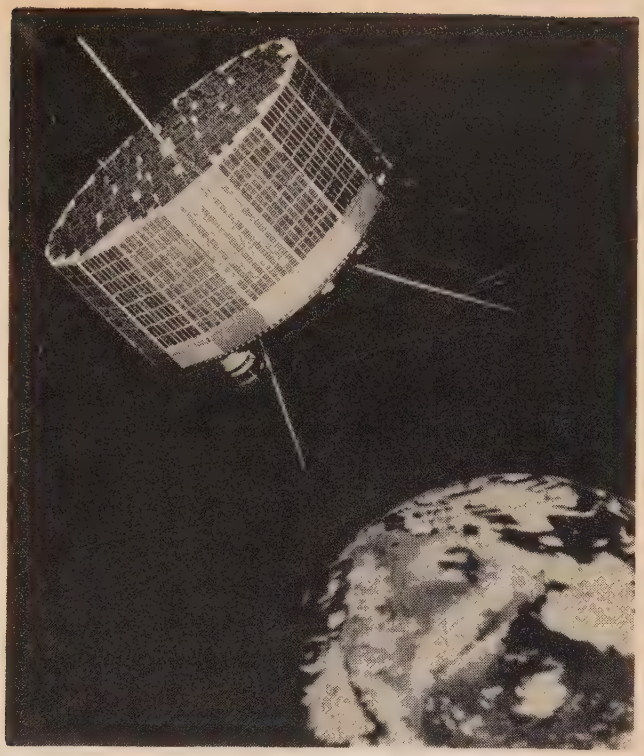
The solar cell consists of a PN junction similar to that associated with the diode. Near the junction the majority carriers diffuse toward each other and unite leaving a net deficiency on each side. The N-region becomes positively charged due to lost electrons while the P-region similarly acquires a positive charge, creating an electron field which discourages further recombinations. The N and P-regions also contain a great quantity of valance electrons which may be activated by heat or light. The valence electrons are the reason semiconductors are temperature sensitive. As the temperature increases, thermally excited valance electrons available for conduction continue to increase.

The material contains the high energy electrons and the valance electrons. If a photon of light strikes a valance electron, it may impart sufficient energy to convert it to a high energy conductance electron. This electron and the associated hole, will be affected by the field near the junction. The electron and hole will travel in opposite directions and create an electric current in an external circuit. The amount of power generated will be directly proportional to the radiant flux since each photon can liberate only a fixed amount of valance electrons. The standard 1 $\times$ 2 centimeter solar cell will produce an average of 0.4 volts at 15 to 20 ma.

Manufacturing and construction of the cells is interesting. The pure silicon is doped with group *V* impurities such a phosphorous, arsenic or antimony and grown in sausage form about 1.5 inches in diameter. The elongated crystal is then cut into wafers about $^1/_{50}$th inch thick, ground, lapped and chemically cleaned. The wafers are then heated in a boron atmosphere in a quartz diffusion chamber. Boron diffuses into the outer surface creating a P-N junction about 0.0001 inches deep. A tiny strip is plated onto the surface of this junction which becomes the positive contact. The entire back of the wafer is plated and becomes the negative terminal.

The cells are then graded with an artifical solar source. Like transistors, no two cells are exactly alike and they produce different power outputs for a given amount of "sunlight." The amount of power compared to the theoretical maximum (100 milliwatts per cm^2) determines the efficiency of the cell. The scientists skim the cream off the top by purchasing cells which exceed approximately 12% efficiency. These cells are further processed by cementing ultra violet filter glass plates to the surface. This increases the efficiency in outer space by reducing heating and further protects the surface junction from errosion due to space "dust."

Fortunately for amateurs and experimenters not all the cells are purchased for space vehicle projects. The lower efficiency cells are made available to amateurs, experimenters and



The Tiros satellite is covered with thousands of silicon solar cells to keep the battery power system charged. The photo in the lower right was actually transmitted to earth by Tiros in sections and pieced together. Note the size of the United States and its cloud cover.

schools at nominal cost. One company (International Rectifier Corp.) has packaged these cells into a lenticular lens type of case and distributes them through radio stores along with a booklet containing many experiments using the cells.

One project, a solar powered broadcast band radio, is shown in fig. 1. It is a glorified crystal set, consisting of L_1, C_1 and the crystal diode CR_1. The detected signal is amplified by the transistor (which can be any general purpose PNP audio type) that is powered by the solar cell. The circuit works well even with a 20 foot antenna and picks up three local stations. The dial was covered with stations when a 75 meter dipole was used.

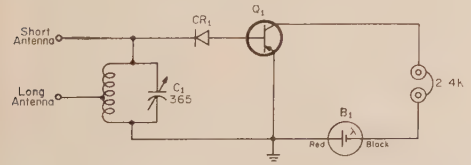


Fig. 1—Schematic for the transistor radio powered by one solar cell, B_1 (B2M, B3M, S1M). L_1 consists of standard loopstick (J. W. Miller #2001). Transistor Q_1 may be any general purpose PNP type while diode CR_1 may be a 1N34.

My first experience with amateur radio applications for solar cells was a sun-powered 15 meter transmitter running 85 milliwatts input on c.w. The "power supply" consisted of five International Rectifier shingles (a group of series or parallel connected 1 × 2 cm. cells) of five cells each. Conditions were excellent one day and I had the good fortune to have a two-way contact with Win McGee, ZL3DX in New Zealand. I believe this was the first amateur transmission using solar power.

As a similar experiment, my good friend Major Gilbert, K6LMW, designed and constructed the worlds first solar powered transceiver. The transmitter unit, which operated on 10 meters, is shown in fig. 2. Major contacted many stations with this unique phone rig and surprised many a ham when he learned he was talking to a completely transistorized station operating from solar power (this was in 1957)! The power supply for the transceiver consisted of 77 Hoffman solar cells!

Recently (Armed Forces Day) two-way contact was established between two solar powered stations operating on each coast. Hallicrafter FPM-200 s.s.b. transceivers were used at each end of the circuit. How can you top that!?

Changes

With this month's column, the editors are making several changes. In an effort to provide more space for construction articles, the SEMICONDUCTOR COLUMN is to be absorbed by the V.H.F. COLUMN which I will have the extreme pleasure of conducting. This is not illogical when one considers the trend to solid-state v.h.f. applications. I am working on several surprises in the parametric field that should be of interest to you.

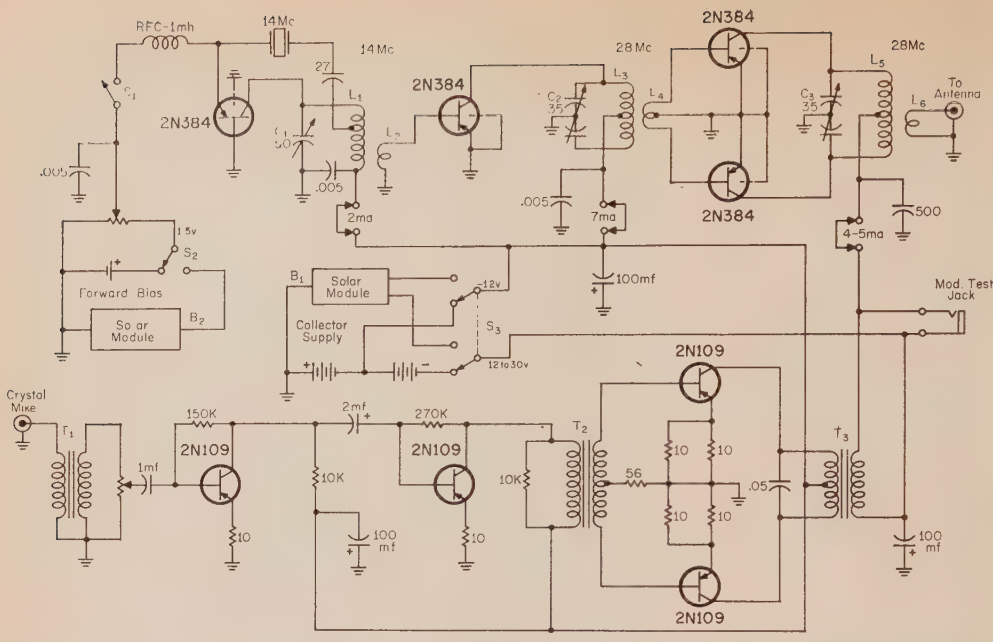


Fig. 2—Schematic for the K6LMW 10 meter phone transmitter. Note the provision for switching from solar batteries to standard chemical batteries. The receiving section consists of a Regency converter and receiver operating from the same solar panel.

L_1—9t. #18, ¾" dia., ⅝" long, tapped 4½ turns from cold end. Adjust to resonate at 14 mc. Add fixed C_1 if necessary. (Tap may have to be moved

L_2—1t. #20, ¾" dia. between 4th and 5th turn of L_1.

L_3—10t. #20 c.t. ¾" long. Resonate to 28 mc.

L_4—1t.c.t., #20, ¾" dia. In center of L_2.

L_5—8t.c.t., Air Dux #816, 4t. each side of c.t. spaced ¼" resonate to 28 mc.

L_6—3t. Air Dux in center of L_3.

T_1—Triad TY-59X Sec. to Mic., Pri. to gain control.

T_2—Triad TY-52X Pri. to driver, Sec. to output transistor bases.

T_3—Triad T-41X Sec. to modulator output transistor (collectors), Pri. from xmtr supply to c.t. of L_3 in xmtr.

B_1—72 2A Hoffman Silicon Solar Cells.

B_2—5 120C Hoffman Silicon Solar Cells.

Semiconductor News

General Electric Co., Syracuse, N.Y., is marketing a new series of planar epitaxial passivated transistors of silicon, designed for switching and r.f. applications to 150 mc. They are types 2N2193 through 2N2195 and 93A through 95A. Also new is a silicon planar group types 2N696 through 699, 2N1613, 1711 and 1893. GE has announced a new all diffused low current Silicon Controlled Rectifier, known as the C5, rated to 400 volts at 1 ampere. Bulletin PR-11 tells about the planar transistors, while Bulletin 150.10 describes the SCR's.

Heath Company, Benton Harbor Mich., has just announced an educational kit which describes basic transistor concepts and practical circuit applications. The well written textbook in the EK-3 kit contains a storehouse of information that would be valuable in any reference file. Also new from Heath is a transistor portable designed as a beginners' kit. It contains all the parts and tools required to build the kit and should convince anyone they can construct a Heathkit. After hearing it, builders are convinced transistors are here to stay.

International Rectifier Corp., El Segundo, Calif. have announced production on a series of 3 and 5 ampere Silicon Controlled Rectifiers along with a new device for triggering the SCR with sharp wavefront pulses. Bulletins SR-358 and 359 describe the SCR's while bulletin SR-365 gives the trigger characteristics. Also of interest is a series of 46 preferred 10 watt zener regulators from 6.8 to 200 volts, JEDEC types 1N2970 to 1N3015. Bulletin SR-266X gives the data.

One of the best written and most informative pieces of manufacturers literature is the bulletin titled *How to Get More Value Out of a Transistor Data Sheet* by Sukert and Baker of Motorola. Copies are available from Motorola Semiconductors, 5005 E. McDowell Rd., Phoenix 8, Arizona.

National Transistor, Lawrence, Mass., have announced a new ruggedized type of germanium diode said to withstand up to 50,000 G's.

Rayclad Tubes, Inc., Redwood City, Calif., have introduced a new material for encapsulating diodes and other small electronic devices. It consists of a thermo-shrinking tubing made of modified polytetrafluorethylene which shrinks

[*Continued on page 113*]

YL

BY LOUISA B. SANDO, W5RZJ
4417 ELEVENTH ST., N.W.,
ALBUQUERQUE, N. M.

Results 22nd YLRL A.P.

Congratulations to the winners of YLRL's 22nd Anniversary Party Contest!

1st phone—K5BJU, Harriett Woehst..12,980
2nd phone—K5YIB, Barbara Houston .12,825
3rd phone—K5BNQ, Doris Anderson..12,600
1st c.w.—KØIKL, Joyce Polley..... 3,238
2nd c.w.—K5BJU, Harriett Woehst.... 3,106
3rd c.w.—W9MLE, Lanola Putnam.... 2,775
Corcoran Award—
K5BJU, Harriett Woehst.....16,086

In the c.w. section held Oct. 25-26 KØIKL, in 1st place, came in second in '60, 1st in '59 and second in '58. K5BJU and W9MLE moved into the top three for the first time, although W9MLE had placed high for her district for several years.

The gals with the top three scores in the phone section, held Nov. 8-9, "did battle" again for they are the same YLs who earned the high scores in last year's contest. K5BJU, 1st this year, placed 3rd in '60 (2nd in '58; K5YIB, in 2nd place, was 2nd last year (1st in '54, '55 & '56 as W3OQF and within the top 3 on phone or c.w., or high for district in other years since '51, in '57-'58 as KØLYV). K5BNQ, in 3rd place, was top scorer in '60 (and '59). Well done, gals! You surely rolled up the scores and left any other competition far behind.

Congratulations to YLRL's member No. 1,000! She is WA2RLW, Thelma Bomyea, of Star Lake, N.Y. and needless to say she was thrilled with the honor and the gifts received. Thelma got her ham ticket in March '61 with encouragement from her son, K2PAP (now in Germany with the Air Force, along with her 4 grandchildren), and with help from W2STA. Thelma works all bands, 15 & 20 preferred, using a Viking Valiant, SX-99 and Hy-gain antenna.

Special congratulations to K5BJU for winning the Corcoran Award, for combined high phone-c.w. score. This is the second consecutive win for Harriett—one more time and she'll get to keep it. For other combined scores, K5YIB placed second with 15,176 points and K5BNQ followed a close third with a combined score of 15,006.

W1ZEN, Onie, who did the log checking, appreciated that YLs took the published log checking procedure to heart and found that most logs were easier to check. She adds that the most common error was counting Md.-Del.-D.C. as 3 in the multiplier, whereas it counts as only one section.

"Project Girlstown"

Among the newest Novices on the air are seven pretty YLs from Girlstown U.S.A. ranging in age from 12 to 17 years (see photo). Since last March the Terry Co. ARC members have made once or twice weekly trips (36 miles each way) to instruct in code and theory. Several other girls are working on their licenses, as is Mrs. Vivian McCracken, Director of Girlstown.

Hams helping in this project are W5NFO, K5JST, W5JMS, K5LFT, W5DRJ, K5CWL, W5HFT, KN5KWZ, K5LFI, K5BDX and several XYLs. At the beginning of the project these girls did not even so much as have a telephone, which since has been installed. Through MARS an emergency power generator has been set up to care for power failures. Other interested people have rebuilt bicycles, swings, radios, and TV sets for these girls, following the Brownfield group's avid interest. All the girls go to public schools and about 30 girls now make their home at Girlstown U.S.A., which is similar in scope to Boys Town in Nebraska.

Look for these YLs on 40 and 75, where they'll be using a DX-60 and HQ-180, furnished by the Brownfield club with assistance of many area hams. If you'd like a sched, write to any of the YLs at Girlstown U.S.A., Whiteface, Texas. Our thanks to K5LFI for this news.

TYLRUN Party

Nearly fifty YLs and XYLs enjoyed TYLRUN's 7th Birthday Party in November, including the newly licensed YLs at Girlstown U.S.A. and their director,

who were special guests at the luncheon. Sponsored by the GABs at Brownfield, Tex., reports have it that they "had a ball." Newly elected officers of TYLRUN for '62 include: Pres. & NCS, K5BNH, Bea; V.P., K5SOT, Bobbie; secy-treas., K5YIB, Barbie; P/C, W5JCY, Bertha.

National Convention

The Portland Roses have started an apron project as part of the YL activities for the National Convention to be held at Portland, Ore. on Labor Day Weekend. They are making aprons from Indian head in a rose motif and will send one to each club that would like to take one (or more?) as a project. They are to be decorated (waterproof pen, textile paint or embroidery) with the club's name, certificate or other appropriate design, plus the names and calls of members. The aprons will be displayed during the convention and drawn for as prizes by the licensed YLs on the last day.

YLRL

A great big congratulations to YLRL and its officers for having achieved membership of 1000 during 1961! (See photo)

W1ZEN, Onie, YLRL president, lists these appointments for chairmen for 1962: Editor *YL Harmonics*, W6DXI, Gladys Eastman; Publicity, K4TGA, Alice Ginsberg; Advertising, W6QYL, Martha Edwards; Supplies, KØGZO, Virginia Bush; Librarian, W6CEE, Vada Letcher; Budget & Finance, W7NJS, Beth Taylor; B&F Members: KØETV, Kay Barclay and WA6NFS, Lois Brickman; Membership; Eastern, W1HOY, Helen Harris; Western, K6BUS, Midge Rommel; International, K5MJW, Betty Becker; Novice, W7DVH, Alice Sturdevant; Nominating Committee, W1ICV, Jane Anderson.

With the Clubs

At their November meeting the RIYL Club re-elected these officers for another year: Pres., K1DWH, Florence; V.P., K1SQS, Jan; secy, W1ZOK, Norma; treas., W1CEW, Mary.

New QTH for the certificate custodian for the LCLYL Net is: K5GYZ, Lucille Miller, 116 S. Glenwood St., El Paso, Tex. The LCL YL cw net meets at 0900 MST Wed. on 7100. . . . The Colorado YLs now have 18 members and are YLRL affiliated.

From K6BX we hear that the Flying Hams' Club officers for '62 include as "Sweetheart" W1SVN, Millie, and as "Natural Ace" W6QPI, Betty.

S.K.

A well loved YL ham, Miriam Fisher Brown, W7JFB, of Mukilteo, Wash., passed away suddenly on November 12. Miriam received her operator's license in '42 and her call following WW II. She had been on s.s.b. since '56. Miriam's OM, Henry, is not a Ham. Two grandchildren took much of Miriam's interest and time, especially year-old Ricky, who has had cystic fibrosis since birth. W7NJS, Beth, a good friend of Miriam's, tells us that many fellow Hams have made contributions to the Cystic Fibrosis Foundation in Miriam's name. Anyone interested in doing so could send contributions to the C/F Foundation, Seattle Chapter, 10817—42nd S.W., Seattle 66, marked "In Memory of Miriam Brown, W7JFB," knowing it would have brought her pleasure.

33, W5RZJ

Some of the W1 YLs enjoyed an eyelash QSO with VK1YL, Denise, during her visit to W1YPH, Leona, this summer. L. to r., W1ZEN, Onie; K1IZT, Blanche; W1ZJS, Dee; VK1YL, Denise; K1EKO, Edie; W1YPH, Leona. Denise and Leona met via 20 meter cw several years ago and have enjoyed many QSOs, never dreaming they'd meet in person.

Rules 13th Annual YL-OM Contest

PHONE SECTION: Starts Saturday, February 24, 1962, 1:00 P.M. EST. Ends Sunday, February 25, 1962, 12 Midnight EST.

C.W. SECTION: Starts Saturday, March 9, 1962, 1:00 P.M. EST. Ends Sunday, March 11, 12 Midnight EST.

ELIGIBILITY: All licensed OM, YL and XYL operators throughout the world are invited to participate.

OPERATION: All bands may be used. Cross-band operation is *not* permitted.

PROCEDURE: OMs call "CQ YL". YLs call "CQ OM".

EXCHANGE: QSO number; RS or RST report; ARRL section or country.

SCORING: A. Phone and c.w. sections will be scored as separate contests.

B. One point is earned for each station worked, YL to OM, or OM to YL. A station may be contacted no more than once in each section of the contest for credit.

C. Multiply the number of QSOs by the number of different ARRL sections and/or countries worked.

D. Contestants running 150 watts input or less at all times may multiply the result of item "C" by 1.25 (low-power multiplier).

LOGS: Copies of all phone and c.w. logs, showing claimed scores, and signed by operator, must be postmarked not later than March 25, 1962, and received no later than April 8, 1962, or they will be disqualified. Please file separate logs for each mode of operation. Send logs directly to Lillian Byrne, K2JYZ, Vice President YLRL, 24 Stillwell Pl., Freeport, L. I., N. Y.

AWARDS: 1st place Phone: YL Cup, OM Cup; 1st place C.W.: YL Cup, OM Cup.

The winner of the phone cup is also eligible for the c.w. cup. Certificates will be awarded to high place c.w. and phone winners in each district and country.

Members of GABs, hostesses for the TYLRUN Party at Brownfield, Tex., l. to r., W5FBM, Viola; Imogene, XYl of K5LFI; W5EZZ, Alma; K5IRB, Donnie; K5MBS, Gladys; K5LSO, Irene; KN5KNY, Inez.

Manufacturer's Buyers Guide

Space and time limitations prohibited the full listing of certain manufacturer's lines in the November 1961 Buyers Guide. We therefore present below an addendum to the main Guide appearing on pages 128 to 137 of the November, 1961 CQ.

Collins Radio Company

Cedar Rapids, Iowa

30L-1—1000 watt p.e.p. input linear amplifier with self-contained power supply for table-top use. Requires 70 to 100 watts drive. Covers 80 through 10 meter amateur bands with provisions for limited general coverage. Features include Automatic Load Control, r.f. inverse feedback, solid state rectifiers, automatic antenna transfer and comparator tuning meter. $520

30S-1—Linear amplifier generating 1 kw average input for full legal power input for s.s.b./c.w. Front panel switch selects proper voltages for 1 kw d.c. input for c.w. Requires 70 to 100 watts drive. Covers 80 through 10 meters and may be retuned for operation from 3.4 to 29.7 mc by adjusting tuned input circuits. Comparator tuning, instant switching from low to high power, Automatic Load Control, r.f. inverse feedback, quiet blower system, and redundant protective circuits are features of the 30S-1..... $1556

32S-1—175 watt p.e.p. transmitter using Collins Mechanical Filter for 2.1 kc transmitted passband. Dual conversion with crystal-controlled, high-frequency oscillator and low-frequency variable p.t.o. Can operate from 3.4 to 29.7 mc except 5.0 to 6.5 mc, with appropriate plug in crystal selections. 80 through 10 meter band crystals included (one 10 meter crystal, 28.5 to 28.7 mc). Companion unit for 75S-1 or 75S-3. Choice of transceive or separate v.f.o. operation. $666

32S-2—Features of 32S-1 with 14 additional 200 kc bands selected by front panel switch. Optional crystals may be plugged into crystal board conveniently located on chassis. $560.50

75S-1—Receiver has 1 kc tuning increments on all bands. Selectivity achieved with Collins 2.1 kc Mechanical Filter and optional 500 c.p.s. Mechanical Filter for c.w. Sensitivity is ½ μv for 10 db S+N/N. Operates 80 through 10 meter amateur bands. System-engineered for the 32S-1, but is compatible with most transmitters. Dual conversion with crystal-controlled high-frequency oscillator and low-frequency variable p.t.o. $520

75S-3—Newest S/Line receiver has all the features of the 75S-1. Additional features are: rejection tuning, variable or crystal b.f.o., 200 c.p.s. crystal filter for c.w. selectivity, a.g.c. selector and concentric r.f./a.f. Gain Controls. These features allow the 75S-3 to be quite versatile for reception of s.s.b., c.w., and r.t.t.y. A.m. reception is provided. $620

KWM-2—Collins rugged, truly versatile transceiver for mobile, portable, and fixed station s.s.b. and c.w. operation on 80 through 10 meter bands. The KWM-2 will also operate from 3.4 to 29.7 mc by installing appropriate plug-in crystal. KWM-2 generates 175 watts p.e.p. input and receiver sensitivity identical to 75S-1,2,3 of ½ μv for 10 db S+N/N. KWM-2A is an extended frequency version with 14 additional 200 kc bands available, switched by front panel control. $1150

312B-3—Contains a 5" x 7" speaker styled for compatibility with S/Line and KWM-2. Companion speaker for S/Line or KWM-2. ..... $32

312B-4—Speaker console contains speaker, r.f. directional wattmeter with 200 and 2000 watt scales and a hybrid phone patch. Front panel switches integrate S/Line and KWM-2 as well as 30S-1 into an operating system. $195

312B-5—Designed for fixed station use with KWM-2. Includes directional watt-meter, speaker, and phone patch in addition to a permeability tuned oscillator. The p.t.o. switching arrangement allows separation of receive and transmit frequencies or for normal transceive operation. This is useful for DX operation. Instant selection of two different preset transceiver frequencies is also switched, which is useful for net operation. $350

302C-3—Measures forward and reflected power on 200 and 2000 watt scales. Coupler unit mounts separately from indicator-control box. $130

DL-1—A 100 watt resistive load. Contains relay for switching transmitter from antenna to load. May be left in the line at all times. Provision for operating relay remotely. Has provision for both RCA type or Type-N connectors. Useful for tuning up transmitter without radiating on band. DL-1 will handle 30S-1 on tune up only. $58

Electro-Voice, Inc.

Buchanin, Michigan

Microphones

600D — Dynamic microphone designed primarily for mobile use. High impact case. High output of —55 db. Available in 50, 250 ohms or Hi-Z d.p.d.t. switch. Six foot coiled cord and panel mounting bracket included $28.50

664 — Cardioid microphone designed primarily for s.s.b. use. Output —55 db. On-off switch (can be wired for relay control). 150 ohms or Hi-Z output

selected at cable connector. Pop proof filter plus magnetic shield. 90 degree swivel mounting $51.00
729SR — Ceramic cardioid microphone for fixed or mobile installation. Flat response from 300 to 3,000 cps. Hi-Z output —60 db $15.90
Built in relay control switch.
951 — Crystal cardioid microphone with variable-D design. Cuts room noise, interference from receiver speaker to a minimum. Hi-Z output —60 db .. $32.70
418 — Matching stand for 951 without switch $6.00
418S — Matching stand for 951 with switch .. $9.00
419S — Matching stand for 664 with switch $9.00
419 — Matching stand for 664 without switch $6.00

Johnson, E. F. Company

Waseca, Minn.

Viking Adventurer — 50 watt c.w. input. Bandswitching 80 thru 10 meters. May be crystal controlled or used with an external v.f.o. Has wide range pi-network output circuit. Catalog #240-181-1 — Viking Adventurer Kit — complete with tubes, less crystals and key $54.95
Viking Challenger — 120 watts c.w. input, 80 thru 10 meters. 85 watts on 6 meters c.w. and 70 watts phone, 80 thru 6 meters. May be controlled by plug-in crystals or external v.f.o. High *"Q"* output circuit is designed to handle 40 to 600 ohm resistive antenna loads. Shaped keying circuits suppresses clicks and chirps. Catalog #240-182-1 — Viking Challenger Kit — complete with tubes, $114.75. Catalog #240-182-2 — Viking Challenger Wired And Tested, complete with tubes $154.75
Viking 6N2 — 150 watts c.w., 100 watts phone. Bandswitching 6 and 2 meters. Viking 6N2 must be used with an accessory power supply — modulator combination, capable of at least 6.3 v.a.c. at 3.5 a, 300 v.d.c. at 70 ma, 300 to 750 v.d.c. at 200 ma, and 30 watts or more of audio. Uses either plug-in crystals or external v.f.o. in the 8 to 9 mc range. The final tank is a dual band tank device and requires no switching or changing bands. A shaped keying circuit is used which suppresses clicks and chirps. Catalog #240-201-1 — Viking 6N2 Kit complete with tubes, less crystals, key and microphone, $129.50. Catalog #240-201-2 — Viking 6N2 Wired and Tested complete with tubes; less crystals, key and microphone $169.50
Viking Ranger II — 75 watts c.w. input, 65 watts phone, completely self-contained. Has built in v.f.o., and provisions for using plug-in crystals. Timed sequence keying is used to eliminate clicks and chirps. A pi-network tank circuit matches 50 to 500 ohm resistive antenna loads. Catalog #240-162-1 — Viking Ranger II Kit complete with tubes, less crystals, key and microphone — $249.50. Catalog #240-162-2 — Viking Ranger II Wired And Tested complete with tubes, less crystals, key and microphone $359.50
Viking Valiant — 275 watts c.w. and s.s.b. (with an auxiliary exciter), 200 watts phone, bandswitching 160 thru 10 meters. May be operated with built in v.f.o. or plug-in crystals. V.f.o. is temperature compensated and each band has separate band spread calibration. Timed sequence keying eliminates clicks and chirps. A pi-network tank circuit matches 50 to 600 ohm resistive antenna loads. Audio system uses low level audio clipping and a built in audio filter which restricts the audio range to 3500 c.p.s. Catalog #240-104-1 — Viking Valiant Kit complete with tubes, less crystals key and microphone, $349.50. Catalog #240-104-2 — Viking Valiant Wired And Tested complete with tubes, less crystals, key and microphone $439.50
Viking "500" — 600 watts c.w., 500 watts phone, and 500 watts s.s.b. (with an auxiliary s.s.b. exciter). May be operated with built in v.f.o. of plug-in crystals. V.f.o. dial has separate band spread calibration for each band. Final amplifier uses a type PL-175A tetrode working into a pi-L network, which will handle unbalanced 52 ohm loads with s.w.r. up to 3 to 1. Push-to-talk control, and 600 ohm phone patch input. Timed sequence keying eliminates clicks and chirps. Catalog #240-500-1 — Viking "500" Kit complete with tubes, less crystals, key and microphone, $749.50. Catalog #240-500-2 — Viking "500" Wired and Tested complete with tubes, less crystals, key and microphone $949.50
Viking Courier — 500 watts p.e.p. (with an auxiliary s.s.b. exciter), 500 watts c.w., 200 watts a.m. linear. Requires 5 to 35 watts of drive. A pi-network output circuit is designed to match nominal 40 to 600 ohm antenna loads. Catalog #240-352-2 — Viking Courier Wired And Tested complete with tubes $289.50
Viking Invader — 200 watts p.e.p. s.s.b., 200 watts c.w., and 90 watts a.m. phone. Uses a special multi-section high frequency band-pass crystal filter, providing unwanted sideband suppression of 60 db and carrier suppression of 55 db or more. Bandswitching coverage for 80 thru 10 meters. Built in v.f.o. has individually calibrated scales for each band. Pi-network is designed to handle 30 to 600 ohm resistive antenna loads. Final amplifier utilizes a pair of 6146 tubes in parallel, bridge neutralized. Catalog #240-302-2 — Viking Invader Wired and Tested complete with tubes, crystals and crystal filter, less key and microphone $619.50
High Power Conversion For Viking Invader — Completely wired and factory tested. Includes power supply, new front overlay panel, extra knobs, additional meter, necessary tubes. A screwdriver-pliers operation converts the Invader to the Invader-2000. Catalog #240-303-2 — High Power Conversion Wired and Tested complete with tubes, ready for installation $619.50
Viking Invader-2000 — 2000 watts p.e.p. s.s.b., 1000 watts c.w., 800 watts a.m. phone. Uses a multi-section high frequency band-pass crystal filter which provides unwanted sideband suppression of 60 db and a carrier suppression of 55 db or more. V.f.o. has a large slide-rule dial individually calibrated for each band. Final amplifier uses 2 type PL-175A pentode tubes in parallel. Pi-network matches 40 to 600 ohm resistive antenna loads. Catalog #240-304-2 — Viking Invader 2000 wired and tested with remote power supply, tubes, crystals and crystal filter, less key and microphone $1229.00
Viking Kilowatt — 2000 watts p.e.p. (with an auxiliary s.s.b. exciter), 1000 watts c.w., 1000 watts a.m. Excitation requirements are 30 watts of r.f. and 1 watts of audio for a.m. 10 watts p.e.p. needed for s.s.b. excitation. Employs two 4-400A tubes in parallel, bridge neutralized. The pi-network output matches nominal 50 to 500 ohm antenna loads. Viking Kilowatt has a class B modulator using push-pull 811 tubes operating in class B. Less than 10 watts audio driving power is needed for full modulator output. Catalog #240-1000 — Viking Kilowatt Power Amplifier complete with tubes, furnished wired, adjusted and laboratory tested, $1595.00. Catalog #251-101-1 — Matching accessory desk top, back, three drawer unit for mounting to right of Kilowatt pedestal, $132.00 FOB Cory, Pa. Catalog #251-101-2 — Same as above but mounts to left of Kilowatt pedestal.
Viking Thunderbolt — 2000 watts p.e.p. (with an auxiliary s.s.b. exciter), 1000 watts c.w., 800 watts a.m. linear. Has continuous coverage from 3.5 to 30 m

[*Continued on page 96*]

Zero Bias [*from page 18*]

tion nets and organizations in the technique of handling "crash" traffic having immediate urgency and extremely short "life."

f—The first flight will improve the knowledge of the art of v.h.f. propagation. Knowledge of Nature is infinite, and large numbers of world-wide amateurs are available for data gathering purposes.

g—The first flight unites the amateurs of the world in a common purpose, a direct result of which will be to promote and enhance the traditionally excellent international goodwill and understanding between radio amateurs.

h—The first flight encourages the exploration and use of the higher frequencies for long distance *random* communication purposes. The "traffic jam" in the high frequency spectrum increases daily, and a real contribution to the art can be made by exploiting the higher frequencies ability to achieve long distance communication. Mass observations of a moving signal that covers the earth may help to solve the radio amateur's intent interest in making the best use of his available frequencies.

i—The first flight requires the creation of a radio amateur organization and accompanying operating techniques that will be capable of fully handling the effort and reducing and interpreting the data it produces. It will, in effect, provide "strength on the bench" and a reservoir of self-trained scientific-minded individuals working as an entity whose efforts can be directed to other useful projects should the need arise.

j—The first flight and its attendant publicity, places recognizable space experiments and goals before the average citizen. He can take part in such goals, to the benefit of all. This experiment encourages general interest, and increased dissemination of "know-how" in the fields of communications and space experimentation. It is hoped that as the layman's knowledge of space grows, his interest, cooperation and contributions will likewise grow.

k—The first flight points the way to future field and laboratory tests significant to the field of communications and should provoke additional questions as well as reveal answers.

The primary objectives are being accomplished by acquisition of the following data obtained from the signals of OSCAR I by radio amateur observers:

1—Qualitative analysis of signal propagation characteristics at 145 megacycles by many observers over a large area of the earth.

2—Measurement of Doppler shift.

3—Attempt to obtain useful predictions of the satellite's orbital path by a statistical analysis of a large amount of relatively low-accuracy tracking stations.

4—Measurement of internal temperature of the satellite to verify theoretical calculated temperatures. Measurement of tumbling rate and slant range.

5—Determination of the lifetime of the OSCAR package.

In addition, OSCAR I will arouse amateur interest in the new age of space communications and will demonstrate once again that radio amateurs are a cohesive world-wide group which can produce useful technical results of no small magnitude.

Additional benefits will, no doubt accrue, that cannot be even imagined at this present time. The answers to questions will pose new questions. Nature is full of duality and riddles. Earnest, continuing attacks upon Nature's secrets are in the best interest of the radio amateur, and serve not only his hobby, but his community, his nation, and the world in which he lives.

The Project OSCAR Association

Announcing [*from page 16*]

100-F award for working 100 QCWA members. Membership is open to any amateur offering proof of 25 years as an amateur. K6BX, awards chairman for the QCWA lists a complete roster of members in *The Directory of Certificates and Awards.*

North Florida

The "Wacky Wing Ding Gang" now renamed the North Florida Amateur Radio Society wants everyone to know they elected K4GFV President, K4YTB Vice President and K4YNM secretary for 1962.

S. 2361

Bill S. 2361 will be coming up in Congress shortly. *Please* write to your representative in Washington NOW! Reciprocal licensing is an important phase of international amateur exchange; give it your wholehearted support.

Correction

As long as you're reading this, grab the October, 1961 issue, turn to page 26 and correct the 680K resistor at pin one of V_7 to read 680 ohms. A few sharp eyes caught this one.

AF-68 [*from page 62*]

bridge. A capacitor filter is used for the 500 volt output; for 250 volts, a pi (with choke) filter is employed. An OB2 provides the 105 volt regulated output. Both the 115 volt line and the 6 and 12 volt power inputs are fused.

Accessories available soon are a wired harness with two Jones female connectors suitable for use with the AF-68 and the PMR-8 receiver and an Amphenol 8-pin female plug. ■

DX [*from page 65*]

6W8DT	POB 3033, Dakar, Republic of Senegal, West Africa
9N1CJ & 9N1MD	Ralph Dennis, WBCJ, 5232 Wentworth Drive, Oxen Hills, Washington 2, D. C.
9Q5AAA	Via W2HMJ
KJ6BV	Via WA6HOH
VK9AD	Via VK3CX
ZD1A	Via VE7ZM
ZD8JP	John Packer Ascencion Auxillary Air Force Co. Via Patrick AFB, Florida

While on the subject of QTH's I have on file here over 2000 QTH's of DX stations that are other than *Call Book* address or QSL managers. This list is kept up to date as possible. If you would like to have any help with a QTH I would like to be of service if possible. Just drop me a line and include a self addressed post card or SASE and I will do my best. Likewise if you have any QTH information please let me know. [73, Urb, W2DEC]

Buyer's Guide [*from page 94*]

Drive requirements are approximately 10 watts in class AB2 linear, 20 watts class C c.w., uses two type 4-400A tetrode tubes in parallel, bridged neutralized. Pi-network matches nominal 40 to 600 ohm antenna loads. Catalog #240-353-1 — Viking Thunderbolt kit complete with tubes, $524.50. Catalog #240-353-2 — Viking Thunderbolt wired and tested complete with tubes $589.50

Viking 6N2 Thunderbolt — 1200 watts p.e.p. s.s.b. (with an auxiliary s.s.b. exciter), 1000 watts c.w., 700 watts a.m. linear. Excitation requirements are approximately 5 watts in class AB1 linear or 6 watts class C c.w. When used with the Viking 6N2 transmitter-exciter or similar unit, the non-inductive input circuit requires no grid tuning. Employs two bridge neutralized type 7034 coaxial type tetrodes. The pi-network output matches transmission line impedances from 30 to 300 ohms. Catalog #240-362-1 — Viking 6N2 Thunderbolt kit complete with tubes, $524.50. Catalog #240-362-2 — Viking 6N2 Thunderbolt wired and tested complete with tubes $589.50

Mark Mobile, Inc.

5441 W. Fargo Ave.
Skokie, Illinois

Antennas

The Mark Mobile Company produces among other commodities the Heliwhip antenna. The HW series Heliwhips are fiberglass molded continuously loaded whip antennas for the 10, 15, 20, 40, 80 meter amateur radio bands. These whip antennas are designed to replace the conventional stainless steel quarter wavelength whips as well as base-loaded and center-loaded normally used in mobile operation.

HW-80	80 meter Heliwhip	$10.95
HW-40	40 meter "	$10.95
HW-20	20 meter "	$10.95
HW-15	15 meter "	$ 9.95
HW-10	10 meter "	$ 9.95
HW-6	6 meter "	$ 9.95

This series is available with the exception of the 10 and 6 meter antenna in a longer length. Mark mobile has a HW-special frequency series designed (cut) to any frequency in the range 3 mc through 15 mc. The HWD series are Heliwhip dipoles for fixed station operation.

HWD-40	40 meter dipole	$29.95
HWD-20	20 meter "	$27.00
HWD-15	15 meter "	$24.00
HWD-10	10 meter "	$22.50

HW-3 — Three band Heliwhip mobile antenna covers 10-15-20 meters without traps or mechanical switching $19.50

CVS-2144 — 2 meter mobile antenna, allowing a v.s.w.r. of less than 1.5 : 1 at operating frequency within a bandwidth of 2.5 mc, easily mounted on roof top or in the center of the trunk lid $7.50

HWM-1 — Heavy duty molded fiberglass mount $7.50

SA-1 — Swivel adapter for the HWM-1, permits full 90 degree turn $3.00

Reciprocal Licensing Bill S. 2361 needs your support. Write your representative today!

S.S.B. Exciter [*from page 60*]

Typical Operating Conditions

Typical operating conditions with the exciter feeding a 50 ohm load or a doublet antenna at its resonant frequency is as follows for Class AB_1 operation:

No signal plate current	
2E26	20 ma
Maximum signal (single tone or carrier) 2E26	47 ma
Screen volts	216 volts (regulated)
Plate voltage	400 volts
Output measured	10 watts

Maximum plate current should be kept under 50 ma for maximum loading if you desire to stay in class AB_1 operation. The plate current will swing from between 20-40 ma while talking into the microphone when the 2E26 is loaded to maximum output.

A.M. Operation

Turn one of the carrier pots until the loaded plate current is 40 ma. Advance the audio gain until a slight flicker of the plate current is seen when talking into the microphone. Back off the audio gain slightly and proceed to operate.

C.W. Operation

The audio gain should be turned off when it is desired to operate the exciter on c.w. Unbalance the carrier pots until the amplifier is operating at the desired level as indicated by the plate meter and or output indicator; connect the key to J_2 and operate. You will have an excellent c.w. transmitter and exciter. When using the rig as a c.w. exciter you can drive the 2E26 into the grid current region if you so desire. This will be indicated by the plate current when it exceeds 50 ma with the final loaded. This will increase the output considerably.

Summary

The authors have sincerely tried to make the design of this exciter (or did we end up with a transmitter?) sufficiently flexible that it will meet the needs and requirements of as many hams as possible. The many features and options are as follows:

1. Simplicity of design without sacrifice of performance.
2. Straight-forward tried and tested circuitry and design that is easy to duplicate.
3. Unit-by-unit design which further simplifies construction, alignment, and servicing.
4. The "unit design" makes it possible to build unit by unit. In that connection the cost is also in parts instead of being all in one sum.
5. Very flexible option as to p.e.p. to meet ones particular requirements.

The authors feel that they have provided for just about every contingency—however, the best laid plans of mice and men—

IS K6INI THE WORLD'S CHAMPION DX OPERATOR?

Judge for yourself! Read his letter and count the DX he has worked—with only 65 watts and a $16.95 Gotham V-80 Vertical Antenna.

2405 Bowditch, Berkeley 4, California
January 31, 1959

GOTHAM
1805 Purdy Avenue
Miami Beach 39, Florida
Gentlemen:

I just thought I would drop you a line and let you know how pleased I am with your V-80 vertical antenna. I have been using it for almost two years now, and am positively amazed at its performance with my QRP 65 watts input! Let me show you what I mean:

I have worked over 100 countries and have received very fine reports from many DX stations, including 599 reports from every continent except Europe (589)! I have also worked enough stations for my WAC, WAS, WAJAD and ADXC awards, and I am in the process of working for several other awards. And all this with your GOTHAM V-80 vertical antenna!

Frankly, I fail to see how anyone could ask for better performance with such low power, limited space and a limited budget. In my opinion, the V-80 beats them all in its class.

I am enclosing a list of DX countries I have worked to give you an idea of what I have been talking about.

Wishing you the best for 1959, I am

Sincerely yours,
Thomas G. Gabbert, K6INI (Ex-TI2TG)

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FACTS

- If K6INI can do it, so can you
- Absolutely no guying needed.
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- Will work with any receiver and xmitter.
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- Uses one 52 ohm coax line.
- Mount it at any convenient height.
- No relays, traps, or gadgets used.
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City_____ Zone_____ State_____

For further information, check number 22, on page 118

THE CQ HAM MART

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Anyone who tries to go mobile without getting this book, should register for a sanity hearing Bill Orr, W6SAI has put everything you need to know in this book. Build-its by the dozen . . . solutions to ignition problems, keeping the battery charged, noise . . . only $2.95 postpaid.

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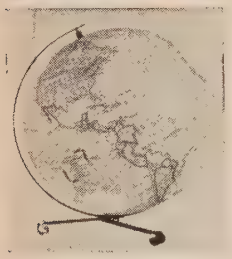
This is a collection of repr containing all of the availabl formation on the conversion the popular "Command" trans ters and receivers into good transmitters and receivers. In able for Novice, Technician, eral, Advanced and Extra clas erators. 136 fabulous, ama terrific pages for only $1.50 paid.



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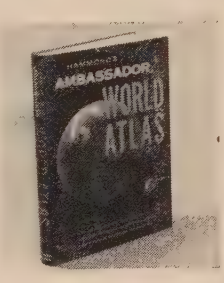

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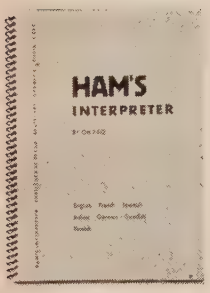

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W1DBM's newly written TVI book (2nd edition) covers all aspects of curing TVI from both the Ham's viewpoint and that of the TV viewer or the TV serviceman. It includes 2- and 6-meter TVI as well as Citizen's Band Industrial, Medical and Utility TVI Profusely illustrated with diagrams, photos, charts, and FCC regulations pertaining to radio and tele interference. Price $1.75 postpaid, USA, $2.00 Fo

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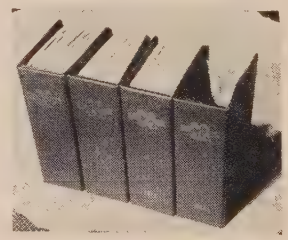
This nifty volume contains the latest dope on amplifiers, pre-amplifiers, and equalizers plus a buyer's guide of component manufacturers! Over 150—5½" x 8½" pages of heavily illustrated descriptions covering Hi Fi Audio Components—the greatest publication value in its field today. Only $2.50 per copy.



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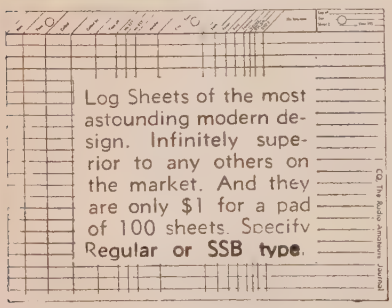

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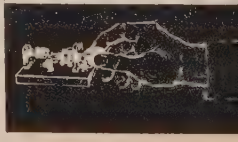

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Most amateurs do not have a good file of back issues of CQ, So we've looked back through the years 1945-52 and assembled all in one place the articles that have made a lasting stir. The issues containing most of these articles have long ago been sold out. The price is a mere $2.00.

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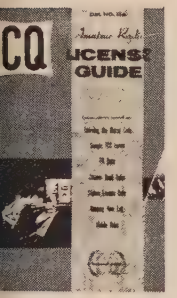
You can't afford to be without this dynamic new handbook designed with the VHF amateur in mind. Filled from cover to cover with all new and original construction material presented so that you can understand it. Written by Frank C. Jones W6APF, nationally acclaimed for his VHF pioneering. Available now for only $3.50.



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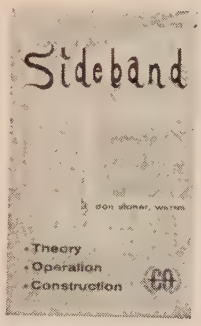

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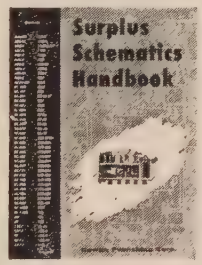
Written by Don Stoner, W6TNS, was almost one full year in the preparation of this terrific volume. This is not a technical book. It explains sideband showing you how to get along with it . . . how to keep your rig working right . . . how to know when it isn't . . . and lots if how to build-it stuff, gadgets, receiving adaptors, exciters, ampliers Price, only $3.00.

SURPLUS SCHEMATICS HANDBOOK

This is a book literally loaded h schematics for al the curtly popular pieces of surplus r. Most amateurs are well are of the problems encountered purchasing seemingly inexpene surplus units, only to find t no schematic diagram is ilable. Trying to figure out the cuitry cold turkey can be many es more difficult that the most olved puzzle, and purchasing a gle instruction book can run high as $3.50. Why knock your out when you can have a k with complete coverage on ad in your library? All this for only $2.50.



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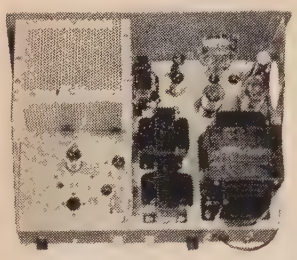
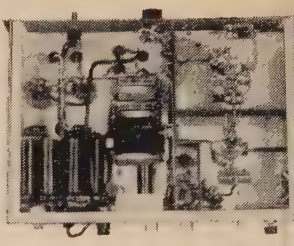
175 WATTS SSB ON SIX METERS with P & H 6-150 TRANSMITTING CONVERTER





Here's the simple, easy way to go VHF on SIX METERS! Just feed the 20 meter output of your present SSB, AM or CW exciter into the P&H 6-150 and you have 175 Watts PEP on SIX METERS, either crystal or VFO controlled, depending on your exciter features. Resistive Pi-Pad and switchable Half-Power Pad permits operation with any 5 to 100 Watt exciter. Since the 6-150 is a high stability mixing device, the output signal stability is the same as that of your exciter. Uses a 6CX8 crystal oscillator/Class A buffer; a 6360 Balanced Mixer and a NEW AMPEREX 8117 push-pull output tube. Power input to 8117 final: 175 Watts PEP on SSB, 165 Watts CW, 90 Watts linear AM. Entire chassis and al shielding is COPPER PLATED. Output jack provide to furnish oscillator signal injection for receivin converter. Quiet 200 CFM forced-air cooling. 50-7 ohm input and output impedances. Husky built-i power supply has three separate rectifiers and filte combinations. Meter reads; PA GRID, PA PLATE an RELATIVE RF OUTPUT. Modernistic curved corne grey cabinet; 9" X 15" X 10½". The P&H 6-15 is so thoroughly shielded, by-passed and parasitic free that it operates as smoothly as an 80 mete transmitter. COMING SOON! THE P&H 2-150 FO TWO METERS!

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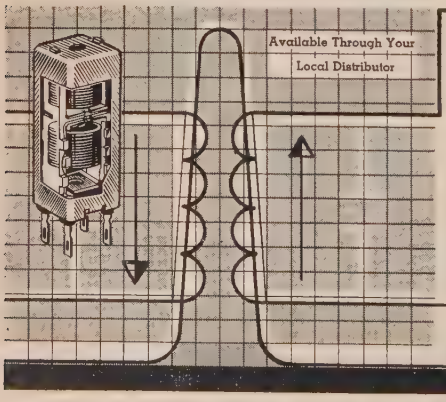
Defense # 1 HEART FUND



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I.F. Transformers

TYPE		ITEM	6 db*	20 db
12-C30	455 kc.	Input/Interstage I.F.	11.5 kc.	30.1 k
12-C31	455 kc.	Output I.F.	13.6 kc.	32.6 k
13-W1	1500 kc.	Input/Interstage I.F.	130.0 kc.	264.3 k
13-W2	1500 kc.	Output I.F.	121.4 kc.	240.5 k
913-C1	455 kc.	Input/Interstage I.F.	8.5 kc.	24.3 k
913-C4	455 kc.	Output I.F.	10.9 kc.	28.6 k
913-W1	1500 kc.	Input/Interstage I.F.	19.5 kc.	61.5 k
913-W4	1500 kc.	Output I.F.	25.6 kc.	73.4 k

J. W. MILLER COMPANY *Tolerance: ±
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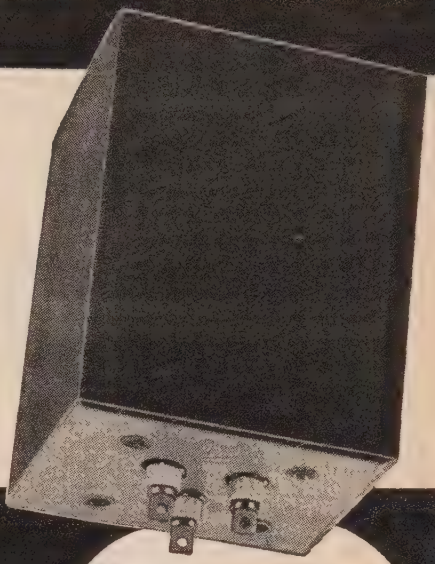

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Kit only

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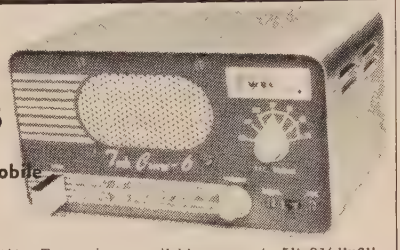

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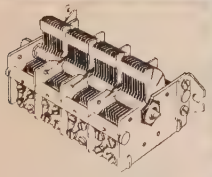

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$20.00 value

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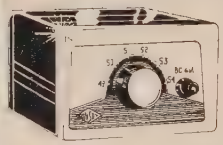

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COUNCIL BLUFFS, IOWA

For further information, check number 27, on page 118

Contest Calendar [*from page 68*]

All I know is that all bands, except the two extremes, 10 and 160, were hopping with activity, especially 40; you've never heard such signals. I predict scores equalling and in some areas exceeding those of the lush days a few years ago.

The following few claimed scores should give you an idea of what to expect. Remember however that these are only *claimed* scores taken from logs received the two week-end following the contest.

I think I have finally found the secret of how to get a good week-end out of our PROPAGATION Editor. In the past I have always pleaded with George, this time however, I threatened him with banishment from these shores if he crossed us up. Nuff said.

73 for now, Frank, W1WY

Sideband [*from page 74*]

Another popular sidebander in Southern Rhodesia is Molly, ZE1JE, who is a "gentlewoman farmer." Married to a chiropractor who is not a ham, Molly manages the 200 acre farm on which they live, cares for the 35 head of Jersey cows, and does her own plowing and tractoring. Add to all this her hamming and the fact that she is the mother of a teen-aged daughter and son and you'll agree that our Molly is quite a gal!

Special announcement: after further investigation regarding the signal of Dan, YO3ZA, we have learned that he is using a single sideband homebrew rig although the unwanted sideband suppression could stand improvement. Therefore, YO3ZA confirmations are being accepted as evidence of two-way s.s.b. contact with Roumania!

Alfred, DJ4WN, still marvels at his success in making WAC with 2 watts of sideband last summer. Bert, ZD1ES, was his first contact; you can't ask for anything more rare than that! . . . Heard and worked our first F3 on sideband; he was Walt Hobby, F3VM, 108 Tact. Fighter Wing, APO 119, New York, N.Y. . . . One of the best Christmas presents a DXer could get would be a new country. Wonder if Danny Weil made the Marquesa Islands by Dec. 25 to play Santa Claus for you all? . . . HB9TL's rig was given plenty of action by FY7YI and probably has shown up at several of the other Caribbean islands by now. FG7 was mentioned and so was VP4 with VE6GY coming down from Canada to do the honors if a license was forthcoming. We sure could use a crystal ball to peer into the future!

Frankly we're getting a wee bit worried, wondering how we're going to bring you all the sideband news with conditions deteriorating more and more each year. It's bad enough to find that there isn't much news but worse to know that we can't often work out of the back yard to get what news is available. So we're going to ask again that you keep in touch with us by mail if you've got something about yourself or any other sidebander that you feel would be interesting.

73, Irv and Dorothy

Propagation [*from page 71*]

These show that 1961's high scores by American amateurs will run on the order of *65% lower* than those scored during the 1960 Contest.

The CW Section was another story. Since radio storms have a tendency to repeat again after 27 days, there was a good possibility that the storm of October 28-29 would recur on November 25-26, right in the middle of the

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HAM MICROPHONE

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WRITE FOR LITERATURE: Dept. No. 25-K

Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.

*Amateur Net

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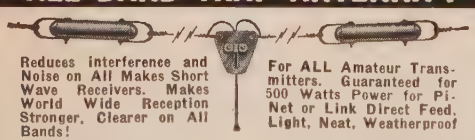

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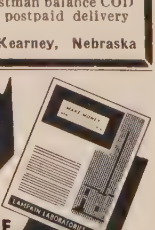

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CW Section of the Contest. November's column forecast somewhat below normal conditions for the beginning of the Contest, improving to normal by the end of the Contest. The CW Section opened at 0200 GMT, November 25 with generally fair-to-good conditions. Twenty, 40 and 80 meters were reported open to many parts of the world, with conditions unusually good on 40 meters, and signals exceptionally strong. At approximately 0600 GMT, November 25, there began what appears to have been a most unusual ionospheric disturbance. Conditions dropped suddenly to poor, and a very loud noise was heard on all bands, apparently originating from the northern auroral zone. By 1200 GMT, however, both 15 and 20 meters opened, with exceptionally strong signals to many areas of the world, despite the auroral noise that was still evident when beams were pointed in a northerly direction.

During the afternoon and early evening hours of November 25, conditions remained good to almost all areas of the world. Both 15 and 20 meters remained open through the early evening hours, when Far Eastern stations were received with good strength. Forty meters opened shortly before sundown, and by the time darkness had fallen, exceptionally strong signals were heard from Europe, Latin America, Africa and Asia, with UAØKYA from elusive Zone 23 reported with good signal strength on the East Coast as early as 7 P.M. EST. Forty meters remained open until after sunrise, with Japanese stations being heard on the East Coast as late as 9 A.M. EST. Conditions on 40 meters were better than they have been for many years, and W1WY reports that several stations may have worked more than 70 countries on this band during the c.w. period. Fairly good conditions were also reported on 80 meters during the hours of darkness, and even 160 meters sounded pretty good, despite the lack of DX activity on this band. Conditions remained fair-to-good throughout the remainder of November 26, and until the Contest ended at 0200 GMT, November 27.

Nature favored the c.w. operator during this past year's Contest. While an ionospheric disturbance is believed to have occurred during the c.w. section (as evidenced by the high noise level which apparently originated from the northern auroral zone, and the fact that MUFs were generally below normal, with few 10 meter openings reported), it was one of those very rare types that cause conditions to *improve*, rather than deteriorate as happened during the Phone Section of the Contest. The exceptionally good 40 meter openings more than offset the very few 10 meter openings reported from the United States, and the initial tabulations received by W1WY indicate that 1961's high c.w. scores may be higher than many of the scores of previous years, with the All Band, Single Operator high score for 1961 likely to exceed 650,000 points.

73, George, W3ASK

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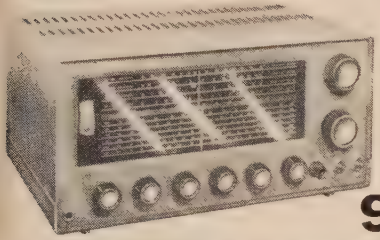

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KT-200WX
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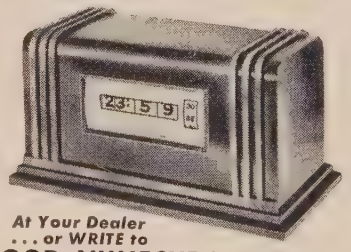

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Caribbean Caper [*from page 43*]

about 2200 GMT for two hours or so and then close down tight.

After eight days of sporadic operation, owing to band conditions, we called it quits with a mere 116 QSO's, with 21 states and 8 countries.

The day before we left I worked a few from Vince's shack signing PJ2ME, and found that his long wire and 90 watts higher up in the band, and out from under the South American teletypes where I had been rock bound, was far more productive.

When judged on conventional DXpedition criteria, namely quantity of QSO's and states/prefixes worked this operation was strictly minor league, but I can truthfully say that I never had a more enjoyable time, in spite of the difficulties we encountered.

People, pace and climate combine to make Sint Maarten a place both Jean and I hope to return to, so with luck PJ5MA may someday again appear for an all-too-brief fortnite. ■

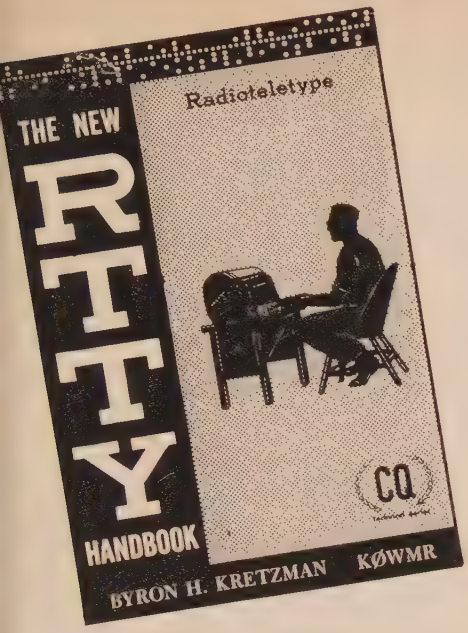
Space Communications [*from page 35*]

Name	*Period (Minutes)*	*Frequency (Mc)*	*Type of Modulation*
Vanguard I	134	108.022	Continuous carrier.
Explorer VII	101	19.9904*	A.m. carrier, with 4 f.m. subcarriers.
Tiros I	99	107.997	Continuous carrier.
Transit II-A	102	162 & 216	Continuous carrier, exceptionally stable signal.
Courier I-B	107	107.971	Frequency modulation.
Tiros III	100	108.0 & 108.03	Amplitude modulation.
Transit IV-A	104	54; 324 & 150; 400	Continuous carrier, exceptionally stable signals.
Injun	104	136.5 (On Command)	A.m. carrier, with 2 f.m. subcarriers.
Explorer XII	1593	136.02	Wideband phase modulation.
Transit IV-B	106	136.8	Phase modulation;
		54; 324 & 150; 400	Continuous carrier, exceptionally stable signals.
TRAAC	106	54; 136.65 & 324	Phase modulation.
Oscar I	92	145.0*	I.c.w., continuous series of HI sent in Morse Code.
Nora-Alice II	91.7	20.0045* & 40.01	Linear polarized c.w.

*Power supply almost exhausted, transmitter not expected to be in operation when this appears in print.

Explorer XI's transmitter, on 108.058 mc since April 27, 1961, was shut off by ground control at 2235 GMT, December 6. NASA also shut down, by ground control, the 108.09 mc transmitter on the SR-3 solar radiation satellite. This transmitter, on the air since June 29, 1961, was silenced on December 5.

In December's column, one of the frequencies shown for Transit IV-A was 52 mc. This was a typographical error, the frequency should have read 54 mc. Incidently, the 54 mc chan-



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nel used by Transits IV-A and B, and by the TRAAC satellite, is on the upper edge of the amateur 6 meter band, and can be received well with average 6 meter gear. Widespread reports of reception of this channel have been received during the past few months.

OSCAR's Spacemate

In addition to OSCAR, DISCOVERER XXXVI carried aboard another piggy-back passenger, called NORA-ALICE II (to rhyme with Borealis, after Pogo). This small payload was also placed successfully into a polar orbit. NORA-ALICE II is part of an ionospheric research program being conducted by the University of Illinois. Its low-power self contained c.w. transmitter is relaying information about the ionosphere back to earth on frequencies of 20.0045 and 40.01 mc, using linear polarization.

George, W3ASK

OSCAR, Technical [*from page 29*]

OFF switch to make contact. At the same time it freed the ¼ wave monopole antenna which had been lashed to the side of the package. A spring in the base of the antenna erected it perpendicular to the case. For the first time OSCAR was in orbit and beeping its call letters HI on 145.00 (actually the frequency was approximately 20 kc low or 144.98 with Doppler correction).

The first stations to hear OSCAR were the KC4's in the Antarctica who had a direct line into Sunnyvale on 20 s.s.b. Approximately 60 minutes later, OSCAR passed over the Kodiak tracking station and continued streaking toward California. The earth however, had rotated about 15 degrees which placed the package about 1,000 miles out over the Pacific. At this writing it is not known if anyone was able to receive OSCAR on the first "pass."

After the first few orbits, the computers had sufficient information to predict arrival times at tracking stations with an accuracy of approximately one second.

This writer stayed up in the wee small hours of Dec. 13 to receive passes 7 and 8. Reception was excellent on a new transistor converter exhibiting a noise figure of 4 db. To test the signal strength, a simple dipole antenna (consisting of two clip-leads tacked to the rafters) was attached to the receiving setup. The signal strength on both early morning passes were approximately S4.

And so the first OSCAR is history now. It is extremely gratifying to note that the people at the data centers in the bay area have been bombarded with tracking reports. Although many of those connected with the project are working around the clock, it is a labor of love. The traffic nets have been observed getting a back-breaking workout and have carried the ball in fine style. The radio amateurs have "come through" in typical ham fashion and the amateur fraternity as a whole, as well as the people connected with Project OSCAR deserve our heartiest congratulations.

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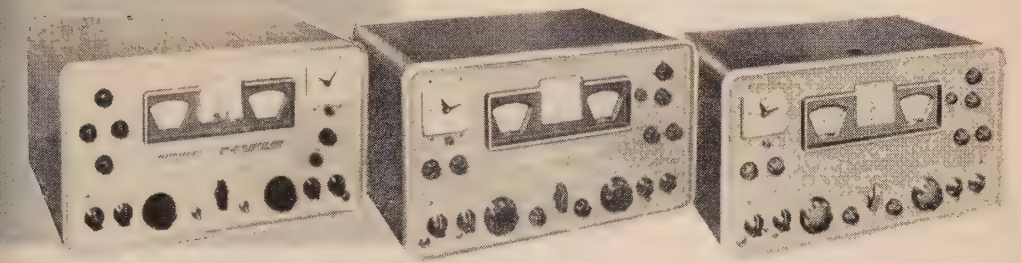

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Novice [*from page 80*]

shorting the dielectric and ruining the capacitor. The voltage ratings are called the working voltage and the peak voltage. The working voltage should be at least 1½ times the rectifier output voltage. There will be a good deal of heat developed in the power supply and this can have a ruinous effect upon the filter capacitors unless sufficient ventilation is provided.

Bleeder Resistor

A bleeder is a resistor connected across the output terminals of the power supply. It is used to place a minimum load on the power supply. The value of the bleeder resistor is usually chosen to draw about ten percent of the output current. The primary purpose of the bleeder resistor is to discharge the filter capacitors when the power supply switch is turned off. The wattage rating of the bleeder resistor is usually between twenty and two hundred watts. If it should burn out and not discharge the filter capacitors, a nasty shock and possibly death could result from coming in contact with the high-voltage stored in the filter capacitor.

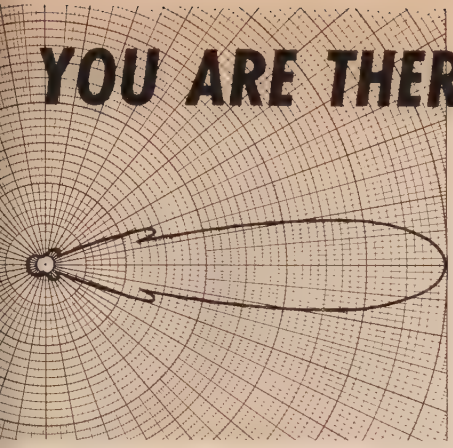
When two or more resistors are connected in series across the output of a power supply, the resistors are sometimes called a voltage divider. The function of a voltage divider is just what its name implies; to divide the high output voltage into two or more lower voltages needed for certain parts of the circuit.

There are several important points to remember from the above paragraphs: (A) Electron flow is from negative to positive; (B) Like charges repel, unlike charges attract; (C) A resistor offers the same resistance to the flow of either a.c. or d.c.; (D) A capacitor passes a.c. and blocks d.c.; (E) An inductor passes d.c. but tends to block the passage of a.c.; (F) A voltage divider system is used to obtain the various voltages needed for the plate, screen-grid and control-grid; (G) Bleeder resistors, because the dissipated heat is high, should be mounted to allow free circulation of air to carry off the heat. (H) Lethal potentials are present in all power supplies. *Be careful: Death is permanent. Please handle all power supplies with respect.*

Building Your First Power Supply

Building a power supply for your projects and experimental circuits is an excellent way to learn electronics well enough to get that coveted amateur license. You will learn best by actually doing the job. You don't forget as easily if you learn by doing.

The power supply shown in fig. 1 can be used to operate small transmitters, receivers and numerous pieces of test equipment. It will furnish all of the necessary plate and filament voltages for many, many projects. The transformer T_1 can be one that has been reclaimed



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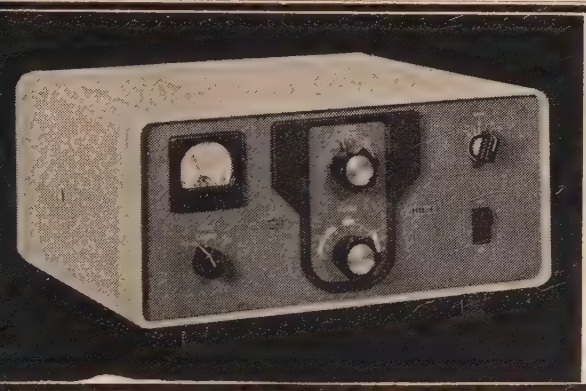

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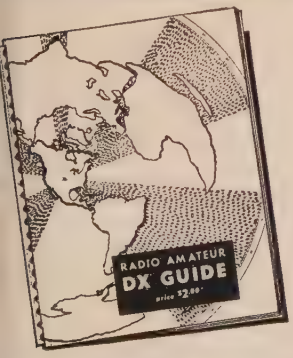

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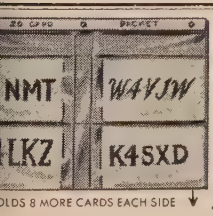

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from an old television set that has outlived its usefulness. If no used television sets are available, any transformer delivering approximately 700 volts center-tapped at about 100 or more milliampere and having 6.3 and 5 volt secondaries will be appropriate for the power supply. The choke should be one capable of passing the current furnished by the transformer. A 200 ma choke can be used for a 150 or 100 ma transformer.

Most electrical component ratings can be varied ten percent either way without appreciably affecting the functioning of the circuit. A series resistor can be used to drop the high voltage to a lower value for a lower plate voltage by using ohms law for computation of its value.

I hope we have some letters and pictures next month so that I can share them with you. I hope to work some of you on the air so that we may become better acquainted. Letters may be sent to Walter G. Burdine, W8ZCV, R.F.D. #3, Waynesville, Ohio. I've had my say, now let's have yours.

Good DX and 73, Walt

RTTY [*from page 87*]

into full-time monitoring of an a.f.s.k. auto-start channel. (See Chap. 3, section 3.4, of the *New RTTY Handbook.*) A transistorized v.h.f. receiver suggests itself here, but we will leave its design to you, or to Don Stoner, W6TNS.

Operation

Adjustment of the BALANCE pot is made with the aid of a v.t.v.m. Simply remove the 2N58 transistors and measure between the arm of the pot and each side. Set the pot so that equal voltages are obtained for *mark* and *space*. The most sensitive 2N404 transistor that you have should be used in the Q_1 position. Input to converter can be obtained by plugging into the 'phone jack on the receiver, if you wish. The polar relay, of course, is used to key a local loop containing the selector magnets of the machine.

"Why do we need an a.f.s.k. oscillator if we are going to operate only on the h.f. bands?" This is a reasonable question. Sure, you can key your v.f.o. frequency-shift circuit directly from the keyboard, but this doesn't result in the cleanest of signals. It is much better to arrange your own switching system so that the a.f.s.k. oscillator is keyed by the keyboard of the machine. The polar relay is then made to key the f.s.k. circuit. Also, then, anytime you wish to go on v.h.f. you are all set to feed the two tone a.f.s.k. into the modulator.

Other Versions

W2JAV has built several other versions of this transistorized TU. One version is a double tuned job, where two toroids, top coupled with a capacitor, are used in each channel. It has the same audio sensitivity as the single tuned job, and it has a pass-band of about 300 cycles

in each channel with the cross-over point (2550 cycles) about 20 db down. The *mark*-to-*space* channel rejection is over 30 db. Phil says that the keying wave form, observed with a 'scope, is the cleanest he has ever seen.

Random Comments

We are purposely shortening the length of the written material, such as operating news, for two reasons. First of all, we wanted to be sure that all of the TU pictures were big enough so you could see the detail. Secondly, operating news is low because we (W2JTP and XYL WA2DUV) are not back on the air as yet, as of December, due to relocation back to the Long Island area.

Don't forget to tune in next month for Part II, the details on the a.f.s.k. oscillator.

Post Script: Have you gotten your copy of the *NEW RTTY Handbook?* If not, just send $3.95 directly to *CQ*, and it will be mailed to you post haste, prepaid.

73, de Byron, W2JTP

---

432 Mc. Converter [*from page 47*]

coupling between L_2 and L_3. The optimum degree of coupling is slightly more than the minimum that will prevent instability with the antenna connected. As a last resort to cure r.f. stage instability, the value of R_1 may be increased. This, however, will somewhat degrade the noise figure and should not be necessary if the r.f. stage is properly constructed.

The overall noise figure as measured with W6NLZ's noise generator is 5.1 db. Judging by on the air performance and comparison with a parametric amplifier, this measurement seems reasonably accurate. ■

Semiconductors [*from page 90*]

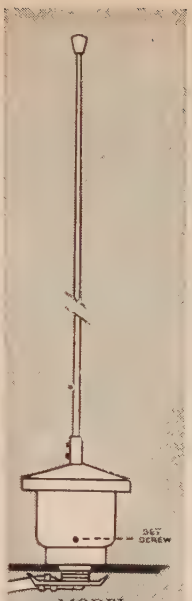
and contours when heated. To use, you slip the material over the diode and heat. It shrinks and produces a skin tight insulation.

Rheem Semiconductors, Mountain View., Calif., is marketing a new silicon high beta transistor. Designated RT-5401 through 5404, the devices feature betas from 210 to 300.

Sylvania Electric, Woburn, Mass., have announced price reductions on more than 50 transistor types ranging from 5% to as much as 40%. They include mesa, drift field and alloy types.

New from **Texas Instruments,** Dallas, Texas, is a series of ultra high speed germanium epitaxial switching transistors designated types 2N960 through 962 and 964 through 966. The devices have a total switching time of 20 nanoseconds. Also new from TI is the first commercial silicon field effect transistor, type TIX690, which has a minimum input impedance of one megohm. If you are interested in the theory of these new transistors, TI has a technical information bulletin available.

73, de Don, W6TNS



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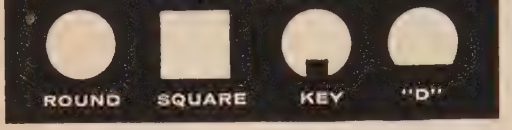

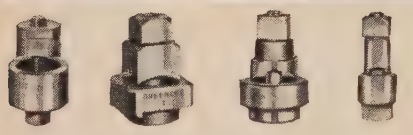

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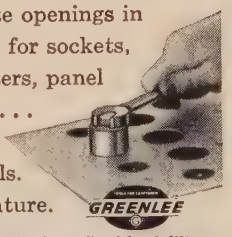

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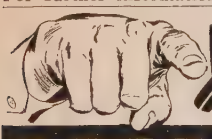

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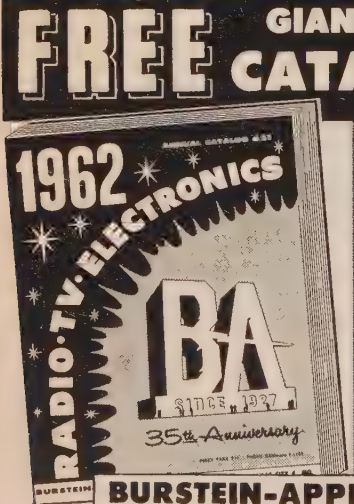

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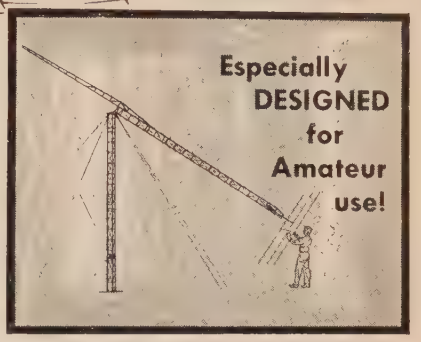

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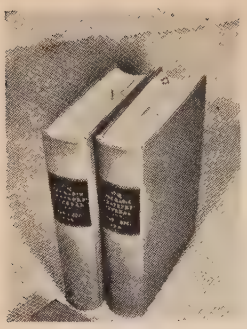

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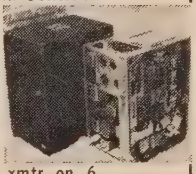

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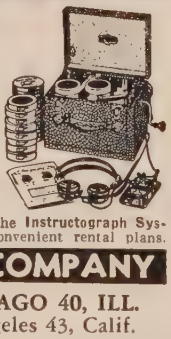

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Kit 5	Sub-Min Tubes

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100 Watts; Tap at 250VDC
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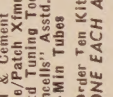

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DC AMP	18VAC 14VDC	35VAC 28VDC	72VAC 54VDC	130VAC 100VDC
½	$1.00	$1.90	$3.85	$5.00
1	1.30	2.00	4.90	8.15
2	2.15	3.00	6.25	11.10
3	2.90	4.00	8.60	13.45
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10	6.10	12.15	26.30	41.60
12	7.75	14.90	30.95	43.45
20	12.85	24.60	*Write For*	
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One Year Grd!

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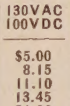

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FOR 6 or 12VDC @ 100A, Type YJ9 $24

"SUPERIOR" Powerstat Type 10 165 Watt 0 to 132V Special $6 each; 2 for $10

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Factory Tested & Guaranteed!

FULL LENGTH LEADS

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$10 or More. This item Postpaid U.S.A.

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0C3	.70	6C6	1.08	50L6	.69
0D3	.50	6C8	1.08	RK59	1.39
0Z4	.79	*We Trade!*		RK60	1.17
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1B3	.99	6CD6	1.49	75	.81
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We Swap Tubes! What Do/U Have?		6CB6	.89	4PR60A	.37.50
1R5	.78	6CG8	1.12	4-125A	.27.50
1S4	.78	6CM6	.79	4X150G	.15.00
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1T4	.85	6CU6	1.29	4-400A	.41.75
1T5	.95	6D6	.99	4E27A	.39.00
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1U5	.75	6F4	2.49	307A	.2/$1
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2C40	5.50	*Send 25¢ for Catalog!*			
2C43	6.50	6F7	.99	388A	3/$1
2C51	2.00	6F8	1.39	350A	2.45
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2E26	2.75	6J7	.99	450TH	.43.00
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2E35	1.60	6K6	.59	460	.11.50
2K25	9.75	6K7	.79	*All Tubes Stocked at Low Prices!*	
2K26	.34.00	6K8	.99	703A	Q
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4X250	.36.00	12BH6	.79	815	1.75
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5Y3	.60	12SF5	.69	957	.3/$1
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Send 25¢ for Catalog!					
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6A7	1.00	12SJ7	.75	1614	2.75
6A8	.99	12SK7	.75	1619	.5/$1
6AB4	.59	12SL7	.79	1620	2.00
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Top $$$ Paid for 304TL, 813, 811A, 812A Tubes					
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6AS7	3.49	24G	3.50	5651	1.35
6AT6	2/$1	25A6	1.19	5654	1.20
6AU6	.79	25A7	2.19	5656	4.25
6B8	1.35	25C5	.81	5663	1.15
6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95
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6BL7	1.35	HV27	19.39	5736	.85.00
6BN4	.69	28D7	.89	5749	1.95
6BN6	1.08	FG33	15.00	5750	2.75
6BN7	1.99	EL34	3.49	5751	1.25
6BQ6	1.19	35A5	.69	5814	1.20
6BQ7	.99	35L6	.59	5879	1.20
6BX7	1.11	35T	4.49	5894	.$12.00
6BY5	1.19	35Z5	1.25		
6BZ6	.91	RK39	2.99	No See—Write!	

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Full Length Leads Factory Tested & Guaranteed!

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2N441, 2N277, $1, 12 for $10.
2N442, 2N278 $3 @, 2N443, 2N174 $4 @, 6 for $23.
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Operation Up to 125° C Case Temp.

D.C. Amps	200Piv 140Rms	100Piv 70Rms	300Piv 210Rms
2	.55	.35	.80
3	1.25	.85	1.50
6	1.50	1.00	1.75
12	1.70	1.20	2.00
35	2.90	2.15	4.95
70	5.60	4.50	10.80
240	8.40	5.70	19.60

50Piv 35Rms	150Piv 105Rms	D.C. Amps	400Piv 280Rms
.25	.45	2	1.00
.60	1.00	3	1.80
.70	1.25	6	2.00
.85	1.50	12	2.20
1.80	2.50	35	6.10
3.75	4.95	70	15.30
4.80	6.90	240	29.75

**Derate 20% for Battery or Capacitive Load or D.C. Blocking!*
**Stud mounted on Heat-sink*

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NEW BATTERY CHARGER BC6-12V FOR 6V OR 12 VOLT BATTERIES, TRICKLE & FULL CHARGE up to 10 AMPS

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Factory Tested Gtd.!
NEWEST TYPE! LOW LEAKAGE D.C. or Batty. Derate 20%

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rms/piv 560/800 .83	rms/piv 630/900 .98	rms/piv 700/1000 1.08	rms/piv 770/1100 1.35

Low Priced T300 Silicon Diodes
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.25 each; 30 for $7; 100 for $22; 500 for $100

Diode order $10 Shipped Post free

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DC-METER One Ma/4" Rd. $5@, 2/$8
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Xmitting Mica's .006 @ 2500V, 5 for $1.00
4x150 Ceramic/LOKTAL ..... 2 for $1.00

For further information, check number 43, on page 118

ONLY AT **ALLIED**

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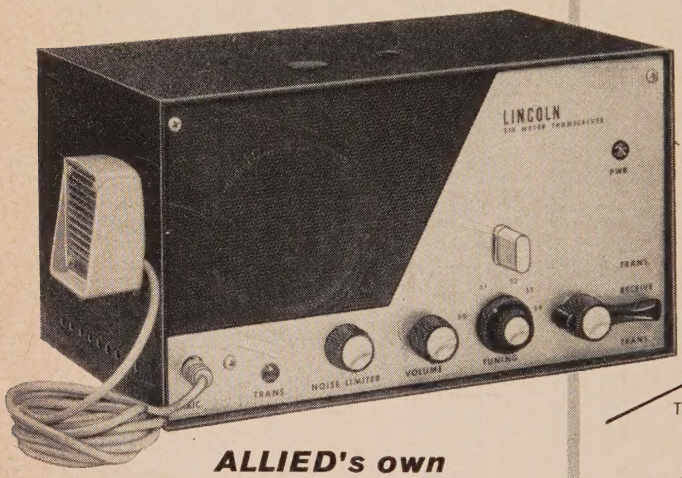

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LINCOLN TRANSCEIVER
COMPLETE WITH
HY-GAIN GP-2C ANTENNA

COMMERCIAL GRADE FIXED STATION GROUND PLANE ANTENNA

BOTH FOR ONLY $74.40

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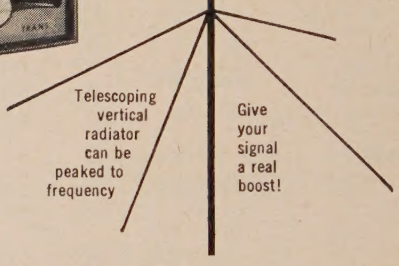

Order your Lincoln Transceiver complete with the famous Hy-Gain GP-2C commercial grade fixed station ground plane antenna, regularly sold at $21.90—get the combination—get top 6-meter action—and SAVE!

20 SX 351-2. Complete Lincoln 6-Meter Transceiver with Hy-Gain GP-2C Antenna. *No Money Down. Only*.....**$74.40**

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$57.50

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GET THE MOST FOR YOUR MONEY

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- **Adjustable Noise Limiter**
- **Front-Panel Crystal Socket**
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78 SZ 195S. *No Money Down.* NET.....**$57.50**

12-Volt Power Supply. 2⅜ x 5⅜ x 4¾". 4 lbs.

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☐ 78 SZ 195S Lincoln 6-Meter Transceiver
☐ 78 S 163 12-Volt Power Supply
☐ 78 S 164 6-Volt Power Supply
$.....enclosed

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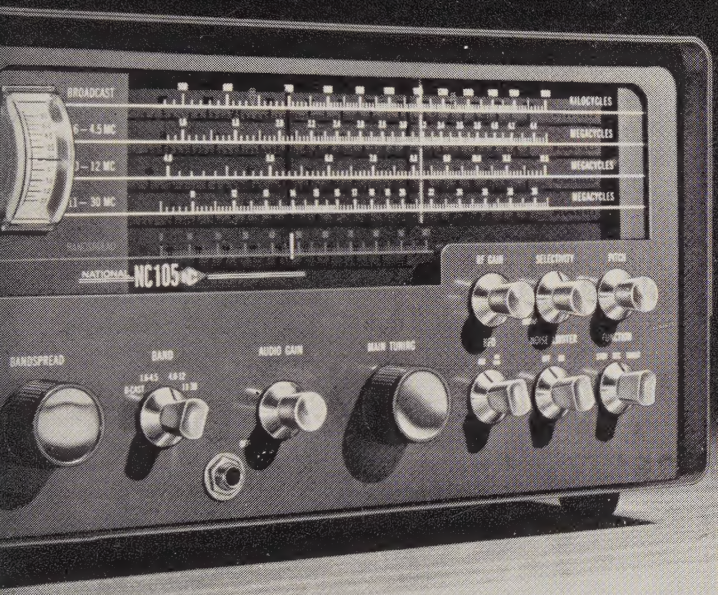
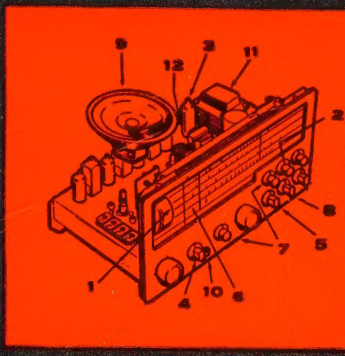
For further information, check number 44, on page 118

National's new, low-priced NC-105





he Features You Want and Need!

ew beginners want to invest two or three hundred dollars in a first er. The choice has always been to spend either that much, or com- se on second-hand or inadequate equipment. Now, National gives new and better choice — a feature-packed, top quality receiver at 119.95!

over the chart at the right. Have you ever seen so many advanced es at such a remarkable price? These are features the novice wants eeds. For example...exclusive National Q multiplier circuitry operates W as well as AM . . . where it's really needed. There are separate RF udio gain controls. AGC works in all modes of operation!

National, with 47 years experience in the specialized design and facture of fine quality receivers could bring you gear like the new 05. If you are looking for an exceptional receiver at a modest price, ask dealer for a demonstration. $119.95 in functional steel cabinet.*

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3. Separate product detector/BFO for CW and SSB reception
4. Continuous coverage from 550 KC to 30 MC in four bands
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Name.....

Address.....

City.....State.....

*Slightly higher west of Rockies and outside U.S.A.

esigned specifically for the novice!

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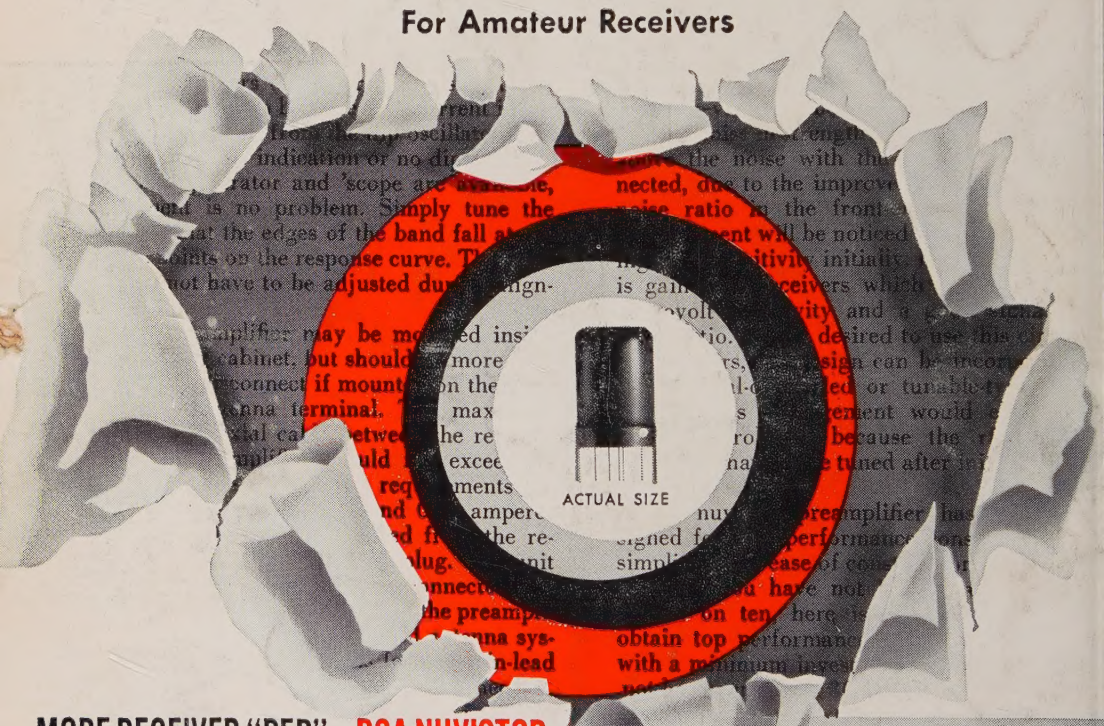
NUVISTOR PREAMPLIFIER

For Amateur Receivers



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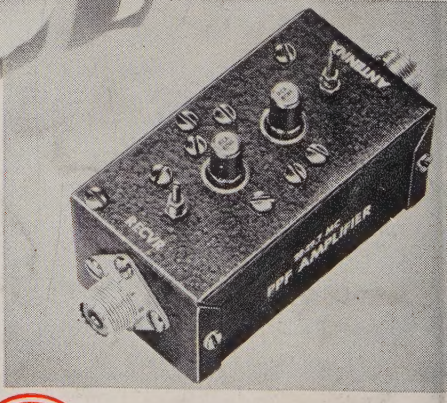
RCA nuvistors in amateur receiver gear provide outstanding performance. The unique capabilities of these tiny triodes have been proved again—in a preamplifier that can add 25 to 35 db gain ahead of the receiver on the 10- and 15-meter bands, and 15 to 20 db gain on the 6-meter band.

Described in the September, 1961, issue of RCA Ham Tips, the preamplifier uses a pair of RCA-6CW4 high-mu nuvistor triodes in a TV-tuner type rf-amplifier circuit.

Get your copy of this special nuvistor issue of RCA Ham Tips today from your RCA Industrial Tube Distributor, or write to RCA Commercial Engineering Dept. 8-15-M RCA Electron Tube Division, Harrison, N. J.



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